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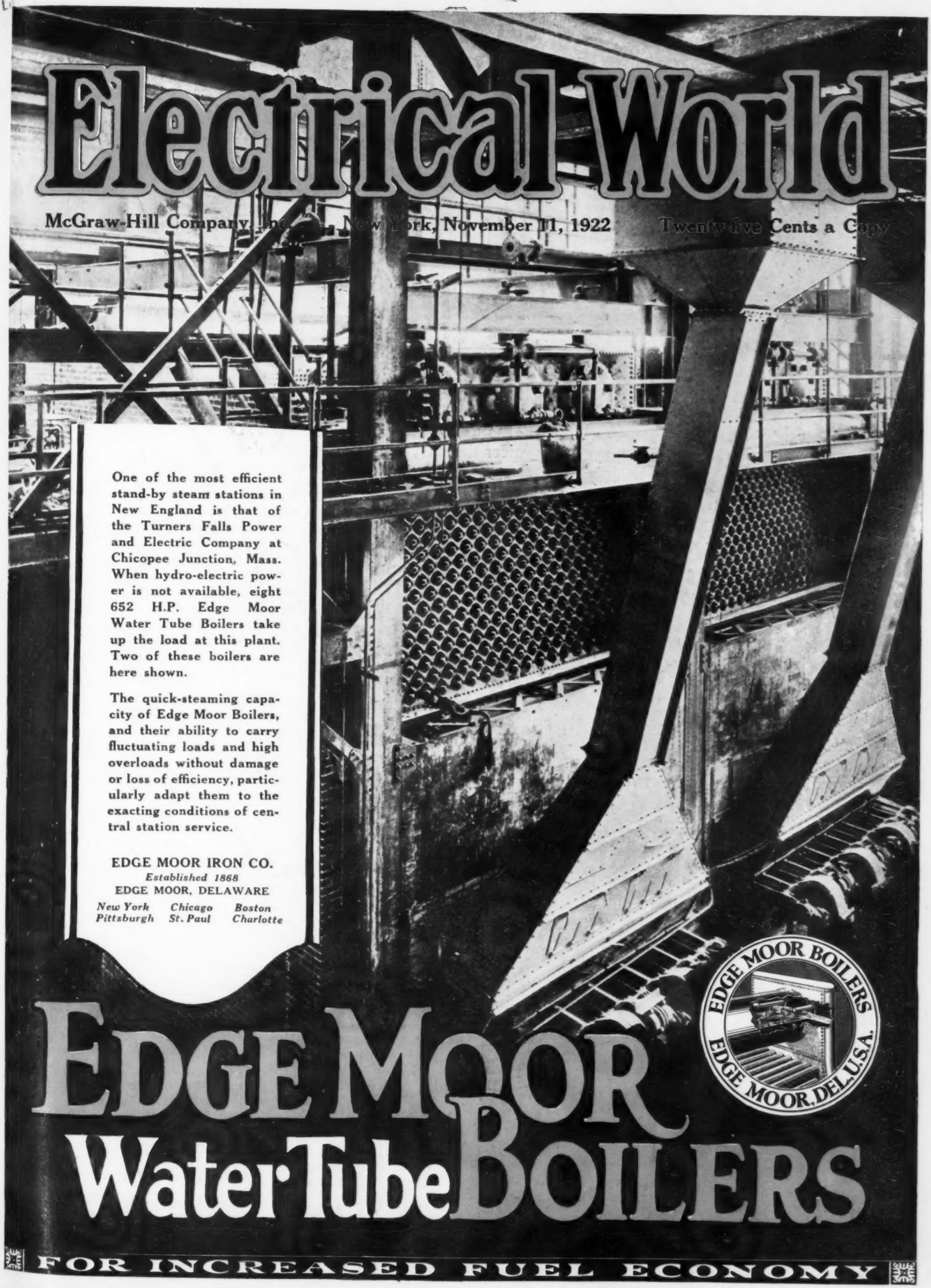
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Our Interest in Immigration

MEN of industry who employ labor are beginning to realize that they are intimately concerned with the immigration situation. To most it has been all abstract—just a matter of theory that each one thinks he himself fortunately need not worry about.

But projected from this background are some facts of very pressing practical importance. In a word, the present trend of immigration is beginning to restrict the supply of common labor to American industries, and this affects us all.

IMMIGRATION first began to assume the proportions of a national problem in this country in 1861. In that year 91,918 immigrants came to our shores. They were of a high character, 98 per cent of them being composed of Scandinavians, Dutchmen, Germans, English, Irish, Scotch. They were as a class thrifty, industrious, orderly, productive, useful citizens who melted well into our population.

But the Teutonic, Scandinavian and Anglo-Saxon peoples no longer migrate. They have gradually won more liberty and prosperity at home and emigration among them has dwindled. Meanwhile oppression and poverty have produced unrest among the Slavic and neighboring peoples—Russians, Poles, Hungarians. So they have come to America in steadily increasing numbers until in 1890 the Slavs composed 83 per cent of our entire immigration, then totaling 455,302. And, having less education and less experience with freedom, the Slav is weaker in intelligence, initiative, stability and productive value to America.

IN BRIEF, there is the story. America continually needs labor, because our industries are steadily expanding. Our one million increase in population does not meet the demands of our farms, mines, factories and construction. Immigration must provide this, unless electrical manufacturers are to be short-handed and electrical utilities hampered in their construction projects—other industries suffering in the same way. We see the urgency and force of this in the recent action of the Steel Corporation in raising wages in the hope of drawing labor from other work.

For the "per centum law," now in control, is a failure. It is decreasing the volume of immigration without improving its quality. And immigration has ceased to bring us the kind of labor that we must have. Immediate relief is imperative.

We must have a permanent constructive policy toward immigration that will solve this problem in both its social and its economic aspects. We must find a way to select the class of immigrants we need that our ideals, our institutions, our industries and our national development may be protected. We must distribute them where the labor is required. Meanwhile we must strive to make the use of electricity increase the productive capacity of the labor that we have.

August F. Hockenbeamer

Originator of the movement for the popular sale of electric utility securities to consumers and a leader in developing good public relations and sound financial policies.

TO ADVANCE a policy that both improves public relations and insures adequate financing is a distinct contribution to the electrical industry. No questions have had greater thought than these, and the fact that the new policy has been adopted by most public service companies in the United States is proof of its merit.

August F. Hockenbeamer, vice-president and treasurer of the Pacific Gas & Electric Company of San Francisco, has proved his sound financial and economic sense in a general way in the various important positions he has held both in the East and the West. But in 1914 his financial acumen focused itself upon a particular policy. This policy is that of the direct sale of public utility securities to consumers and employees. For a long time Mr. Hockenbeamer had pondered upon the problem of the financing of the Pacific Gas & Electric Company. He knew that during the initial steps of such a company it could be financed easily by the mortgage system, but he knew too that there is a limit to borrowing money on this basis. So he conceived the plan of junior financing—that is, financing by means of acquiring creditors among the customers of public utilities. He saw immediately that to make shareholders of the consumers of the Pacific Gas & Electric Company would establish a fine sense of co-operation between the utility and the public besides furnishing the capital necessary to carry out the former's increasing activities. He tested his plan with the California Telephone & Light Company. It proved a success. Within two years' time the most important companies in the East as well as the West had adopted it with unqualified success.

The man to whose fertile brain is due this idea had a training suitable to such an inspiration. He was born on March 6, 1871, in Logansport, Ind. In this railroad town he spent his youth. From the beginning he was interested in the business aspect of railroads. After a public school and business college education he went to work in the Logansport office of L. F. Loree, division engineer for the Pennsylvania lines. Here he began at the bottom of the ladder as office boy and messenger. In six months he was promoted to the position of stenographer, and from that time he advanced to more important places until at the age of thirty-one he was chief clerk to the division superintendent at Richmond, Ind. He then became assistant engineer of maintenance of way for the Baltimore & Ohio Railroad. His next move took him to New York City as assistant to Mr. Loree, now the president of the Delaware & Hudson Railroad. But this important position did not hold him long. The banking house of N. W. Halsey & Company recognized his sound financial sense and made him its expert on railway investments and corporate properties. In his fifth year with Halsey & Company they sent him to San Francisco as their agent in the financing of the Pacific Gas & Electric Company. This utility saw in Mr. Hockenbeamer the same brilliant business ability which had been manifest to Halsey & Company. Its managers made him a tempting offer. He accepted, and for the last fifteen years the West has claimed him as one of its financial leaders.

Under the policy inaugurated by Mr. Hockenbeamer the Pacific Gas & Electric Company has extended its activities enormously, and under it also many companies throughout the East and the West are establishing a better relationship between the public and themselves, thereby bringing about a healthier economic condition. For this reason Mr. Hockenbeamer has won national recognition.

Editorial Comment

Electrical World, November 11, 1922

Volume 80 Number 20

Financial Market Favorable for Refunding

ELECTRIC public utility financing reached its highest point for the year in October, when approximately $100,000,000 was offered to investors. An interesting feature of recent financial operations has been the large amount of refunding made possible by an attractive money market. No sane utility operator wants to be hampered by a 7 per cent bond or 8 per cent note issue if either or both can be replaced with a 5 per cent security, even if a premium must be paid to holders whose bonds are retired.

It is not always appreciated how important a part interest plays in utility operations. In a great many cases the cost of money exceeds the cost of labor, and a saving of one or more per cent in the cost of money affects earnings more than economies in station operation and is just as welcome as a rate increase. For example, the refunding operations of a large public utility last week will save approximately $92,000 in annual interest charges. If the unexpired period of the original security were ten years, the total saving would approximate $1,000,000. No wonder, then, that utility operators should be besieging the offices of bankers at this time. With so favorable a money market there should be a long waiting list.

Court and Commission Decisions on Partial Facts Are Dangerous

ONCE more a legal decision based on only a part of the facts arises to complicate the inductive co-ordination problem. In this instance the Nebraska State Railway Commission bars a 13,200-volt line from the highway on the ground that it would prove a menace to a railway signal system. On the record in the case it is difficult to see how the commission could do otherwise. Again, it is difficult to see how the Supreme Court could do otherwise than uphold the right of the commission to make such a decision when that right was questioned on an appeal. Both the Supreme Court and the commission have apparently done the only thing that the record in the case justifies, so that no criticism of their action can be voiced.

The whole difficulty lies in the handling of the case. A practice has grown up in some sections of the Middle West of allowing contractors and promoters to project and build lines that, after construction, pass into the hands of others. The promoters are acting within their legal rights in the cases that have been observed, but naturally they have no interest in the future of the lines that will lead them to do more than is required to put the circuits in operation and get their money. In the particular case under notice the promoters and expectant builders of the line brought the most vital question in the whole inductive co-ordination problem before the commission and into court. The commission decision was rendered and the case appealed to the Supreme Court before the utility interests of the state had become cognizant of it. The decision, if followed to its logical conclusion, would indicate that power circuits can be barred from the highways, and as a result extension of electric service would be seriously curtailed in the State of Nebraska. The railway case was well presented, but so far as the record shows no attempt was made to bring into it as witnesses men able to show that the power and signal systems could be co-ordinated and operated so that there would be no menace to railway operation. That it has been possible to do this in other cases was not shown, nor was it shown that there are hundreds and possibly thousands of miles of such construction in daily operation in the United States. Neither was there any indication that if railway electrification is to come in this country every mile of track controlled by block signals must operate under conditions as severe as if not worse than those involved in the case in point. It is a serious question whether the railway company in raising the issue has not embarrassed railway electrification just as seriously as the distribution of electrical energy to commercial customers.

As a practical matter there is no reason why such a case should be allowed to go to the lengths that this one has reached. Every power company should be in intimate touch with the inductive co-ordination work of the National Electric Light Association and the situation in its own locality, and when such a case as this begins it should be found prepared to bring all the knowledge of the subject available to the parties at interest so that a fair presentation can be made. Better yet, if the various central-station organizations are alert, such matters can be settled without resort to the courts or commissions.

Penalties of Inadequate Rates

LAST spring Secretary Hoover in a statement to the Interstate Commerce Commission on the economic function of the railroads stressed the importance of keeping utilities financially strong and unhampered by public prejudice or governmental bias. He asserted "that unless we have a quick resumption of construction the whole community—agricultural, commercial and industrial—will be gasping from a strangulation caused by insufficient transportation the moment that our business activities are resumed." The prediction then made has come true, for the country is now face to face with the greatest car shortage in the history of railroading. Lack of transportation is at the bottom of most of the present troubles. Coal, wheat and other commodities cannot be moved expeditiously, and industry is handicapped at the very time when it needs transportation most.

That railroad facilities have not been expanded every-

body knows, but the railroads have been unable to increase their trackage, cars and locomotives because they lack credit, and want of credit is traceable to low earnings, and low earnings in part at least are attributable to inadequate rates. Time and again the country has been admonished not to starve its railroads, but the warning apparently has gone unheeded. State public service commissions, which are not so far removed from public opinion as the Interstate Commerce Commission, have been quicker to sense the dangers of financial starvation, with the result that, so far as electric light and power companies are concerned at least, relief, although at times tardy, has been vouchsafed and the industry has continued to expand and to care for the increased demands for electric service. In this respect the state public utility commissions have shown themselves more far-sighted and responsive than the Interstate Commerce Commission. Unfortunately, however, between the Interstate Commerce Commission on the one hand and the Railway Labor Board on the other the railroads are having a hard time. Theoretically that was not the intention. The idea was that the I. C. C. would assure honesty in finance and justice to the shipper and to the railway industry, while the Labor Board would assure justice to the workers. Practically, however, the combination does not work out that way, and while such a situation may serve as a horrible example to state public utility commissions, it is destroying the railroads and harming all industry. What we need and must have is transportation, and the quickest way to obtain this is to re-establish the credit of the railroads so that they can raise money with which to purchase rolling stock.

Power-Factor Correction on Small Transmission Systems

TOO many utility properties are constructed by pure rule-of-thumb methods. The engineer who has had to take a number of small properties and put them together into a fairly large group with transmission lines tying the various units together is in a better position to appreciate the force of this statement than any one else, because he has so often seen the methods used which make for a minimum of original investment and a maximum of operating and depreciation expense. In many cases the means employed to overcome operating troubles display such a lamentable lack of knowledge of the elementary principles of engineering on which design is based that the situation would be laughable were it not so serious. The chief difficulty is a lack of engineering knowledge to guide the owners of the property in an intelligent reduction of both investment and operating costs.

In an article in the last issue of the *Electrical World* Fred C. De Weese discusses the elementary principles underlying one of the puzzling problems that arose in handling a small system in which a few communities were tied together with transmission lines of low voltage but fair length. A few years ago small systems of this kind where they existed carried small power loads and the power-factor situation was not of great importance. Today such systems are called upon frequently to take on motor loads in a single installation that are a respectable fraction of the total system capacity. The immediate result is an apparent inadequacy of line capacity and a scramble to build heavier lines, which often do not afford an improvement in accord with the price paid. Mr. De Weese points out clearly some simple methods by which the power-factor correction needed for a small transmission system can be ascertained and how data for an intelligent decision as to the best and least expensive way of making this correction can be had. The curse of mathematical complexity has led a great many operators of small systems to assume that the subject of power-factor correction is a closed book except to the big systems. Mr. De Weese shows that this need not be the case.

The Problem of Glare, and Its Need for Investigation

THE recent drive for higher illumination as an aid to industrial efficiency has necessarily brought with it serious consideration of the question of glare, since one cannot obtain intense illumination without the use of numerous and powerful sources. Now, glare is a thing of many phases. Originally, in studying the matter, attention was chiefly directed upon the intrinsic brilliancy of the source, a factor of dominating importance when one passed from mild illuminants like the gas flame to incandescent lamps, gas or electric, of high brilliancy. More recently it has been fully recognized that the quantity of light flux independent of intrinsic brilliancy is very important, and still more recently close attention has been directed to contrast in brightness between the source and its background. For the first time in the Illuminating Engineering Society's code for industrial lighting these several factors have been taken into sufficient account and so tabulated that illuminants can be roughly evaluated with respect to their capacity for producing what in general terms we denominate glare. The data, of course, are frankly empirical, and the tabulations represent merely somewhat educated judgment as to the existence or nonexistence of glare.

The thing to which we particularly wish to direct attention is the need of further investigation of the whole subject, particularly since these preliminary values are likely to arouse considerable discussion when it is attempted practically to apply them. The problem is mainly a physiological one of great intricacy to which observational values based on general impressions apply only with many reservations. Further, the fact is that the three factors of glare here noted are not in truth independent variables. The ultimate physical fact is the concentration of visual energy in the image on the retina, with a further limitation due to the absolute value of this area as compared with the light-receiving elements upon which it falls. Beyond this the matter of contrast is far from being wholly clear of the other phenomena, and all of them depend on a factor which is only intrinsically involved in the matter of background, and that is the particular state of adaptation of the eye. Inasmuch as the retinal sensitiveness varies enormously under different conditions, the background effect may or may not have large significance and the data available are as yet somewhat imperfect. With all these limitations the tabular view of illuminants brought out in the I. E. S. code is of great practical value in classifying the rough facts, which it does from the observational standpoint in a rather complete and satisfactory way. The why and wherefore of the sensation effects here correlated can

be ascertained only after considerable research, but in the larger aspect the glare tables of the code are likely to prove of immense importance in the promotion of better and safer lighting. There is much which we do not know about the theory of vision, yet it does not take much astuteness to discover when a source of light is also a source of discomfort, and therefore inevitably a source of inefficiency and of possible serious harm.

Why Pay Rental for Wire Crossings Over Railroads?

IT IS difficult to understand on what theory some railroad companies proceed in demanding rentals and privilege liability clauses in wire-crossing agreements when the wire crossings are made over tracks at points where highway crossings exist. It is particularly difficult to see any reason in such a course in cases where there are no power-line structures on the railway right-of-way and the only encroachment, if such it may be called, is the suspended conductors over the tracks within the highway limits. Yet the demand is being made, and in some cases the power companies are signing such agreements and putting themselves in the position of asking favors from the railroad company.

There are two situations involved. One is where a power line with a private right-of-way crosses a railway at a point where there is no highway. In this case the power company is probably in the same position that it occupies when dealing with any property owner whose property it desires to cross. The second situation is where highway crossings exist and the power company is operating under regularly granted franchises authorizing it to use the highways. Either case may be complicated by the desire of the power company to place structures on the railroad right-of-way. Generally, in case of real necessity, this can be avoided. Such crossings are governed in most states by commission or legislative action, and the liability of the power company for carelessness that endangers railroad operation is pretty well established. Under such conditions there is no reason why the railroad should be allowed to demand special permits, liability assumptions and rentals.

In this connection a decision of the New York Supreme Court, Appellate Division, rendered July 6, 1920, in an action brought by the New York Central Railroad against the Middleport Gas & Electric Company, is interesting. The railroad objected to the public service company crossing its right-of-way with a three-phase line, notwithstanding that the power company had no poles on the railroad's right-of-way and that its wires were suspended thirty feet above the rails. The court found for the defendant, asserting that the railroad had no greater rights and privileges than those granted by its charter and that the use of the highway for the transmission line in no way interfered with the operation of the railroad, which, even if the structure crossing its lines imposed on it an additional burden, must yield to public convenience.

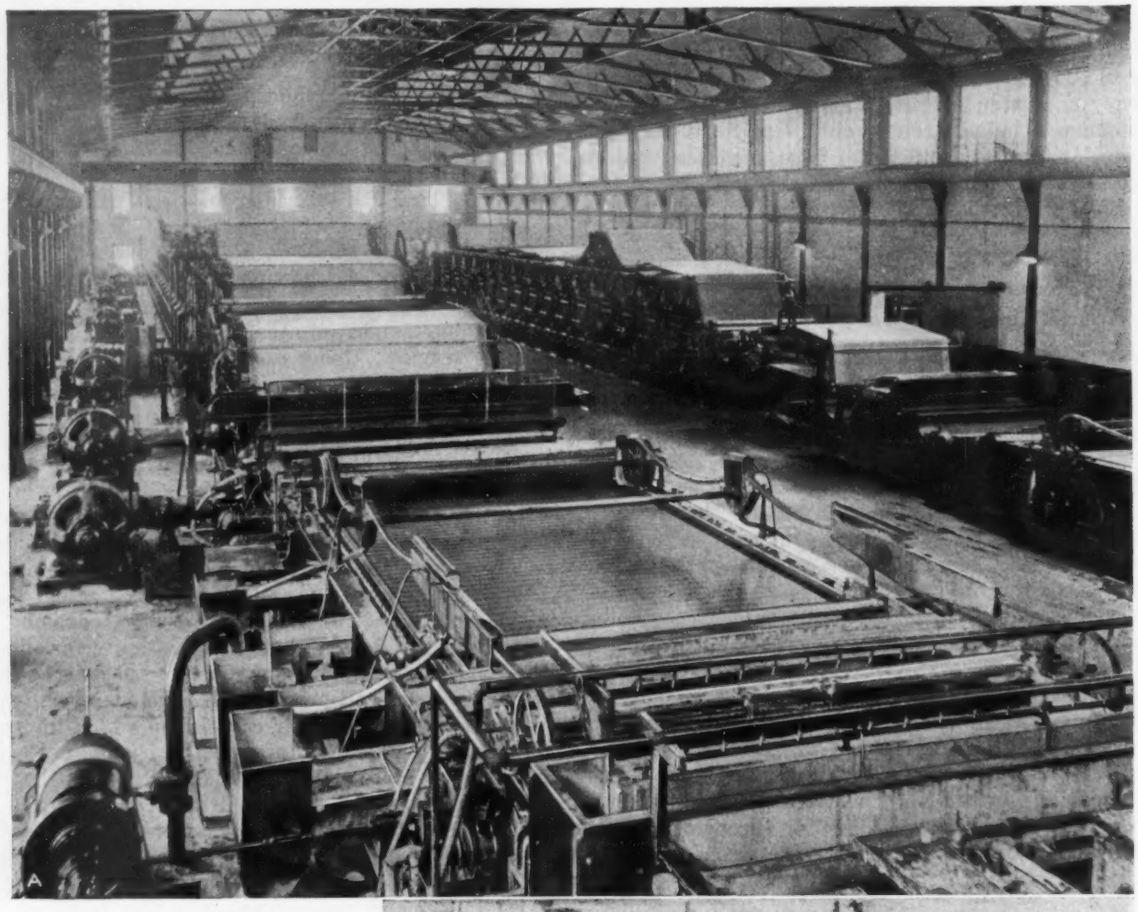
It will be well for central-station executives to scrutinize all crosssing agreements with the utmost care. In addition they should keep National Electric Light Association headquarters informed of the things demanded in such agreements that the establishment of harmful precedents may be halted.

Daylight Variations and Effect on Electric Lighting Demand

IT HAS long been realized by every operator of an electric system that a dark day means heavily increased demand, that a sudden storm may cause a heavy rise in load to come on with great rapidity, and that in general the character of the weather and the call for lights are very closely related. Some companies indeed go to the pains of keeping an actual daylight recorder in service, showing graphically the weather conditions every day in the year, and gain thereby a considerable insight into the probabilities of unexpected calls for service. Under exceptional conditions, such as sudden storms and pocketing of city smoke in the canyons formed by buildings, load has been known to rise at the rate of 1,000 kw. a minute, and the call for desperate activity at the generating stations is so acute that any means of foreseeing trouble is an important aid in continuity of good service.

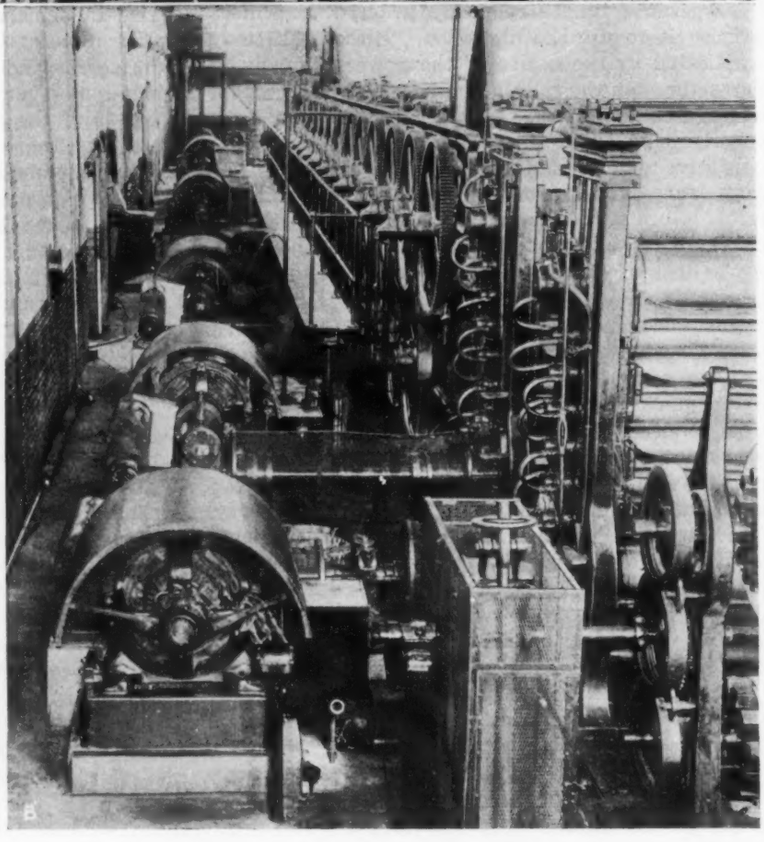
Some exceptionally important data on this subject have been collected by the Potomac Electric Power Company, Washington, D. C., which show the actual fall in exterior illumination with the resulting demand for added lighting. While most of the data are for summer conditions, the winter results must be reckoned as fairly similar in kind—at times very like but more impressive in degree. The particular correlation which impresses one as being of direct practical applicability is that between the foot-candles of illumination in the open and the average call for added artificial lighting. An approximate survey with a photometer compared with the demand records at the station showed that whenever the illumination in the open fell below 1,500 foot-candles a rise in demand was evident, the rise being greater as the illumination fell below this figure. This minimum corresponded to about 360 foot-candles at a west window at 4 p.m. and to about 9 foot-candles six feet away from the window. This condition is absolutely typical of the average office. Near the window the natural illumination is brilliant even when the sky brightness is considerably reduced, but as this brightness falls the gradient within the room seems to increase, so that at ten or fifteen feet inside the windows the illumination has fallen to a very low figure. Even 9 foot-candles, which one ordinarily thinks of as brilliant lighting, is painfully low when it results from a sudden cutting down of the daylight illumination, for it deals with an eye light-adapted to an intense degree and consequently slow in adjusting itself to rapidly increasing darkness. The practical value of illumination at which there is sudden demand for more light is sometimes referred to as the psychological darkness, although it might better be called a physiological darkness, since it is the effect of sudden decrease in upsetting the visual functions. This experimental value of brightness was correlated with the work done in the Weather Bureau, where a constant record of solar radiation is kept, and the data here obtained checked excellently with the photometric readings.

The important feature of the investigation from a practical standpoint is in the possibility it discloses of giving advance knowledge of a drop in illumination likely to pass below the psychological limit, so that due preparations can be made for meeting the demand for light. Where recording instruments can be placed at strategic locations, interesting opportunities are afforded for forecasting the light requirements.



Sectional Drive Invades Paper Industry

THE electric motor finds an ideal application in the paper industry. The size of the machines, the speed control, the power demand and the production process are all elements which favor the motor drive. The wood pulp mixed with water and other liquid constituents is formed in a sheet on the table shown in the upper foreground. It then passes through rolls where various finishing operations occur such as drying, sizing, trimming. These rolls must have adjustable speed control and sectional drive and yet must have fixed speeds relative to each other, so that motor control apparatus is needed which is very sensitive. This condition, combined with the large amount of power required to drive the rolls, has led to new advances in control engineering. The pictures show views of the book paper machines in the plant of the West Virginia Pulp & Paper Company at Tyrone, Pa.



Simplification of Paper Mill Drive Control

A Development in Electric Drive Which Has Produced a Refinement in Motor Control and Regulation Applicable to Many Other Industries — Utilizes the Principle of Differential Frequency

ELECTRICITY has proved to be adapted for power for paper production because of its inherent advantages in generation, distribution and control and because of the superior qualities of the mill equipment developed to utilize the power. The paper mill industry, like the steel industry, requires continuous production, few workmen, an enormous capital investment in plant and machinery and a large area of floor space with applications of large amounts of the energy at widely separated locations. In addition, because of the production process, a refinement in energy control and speed regulation is required to as great a degree as in any other industry excepting possibly the silk mill factories.

The paper business is among the first six industries in this country. In twenty years the number of paper mills in the United States has increased 40 per cent, and the 1,600 mills now installed have a capacity which has changed from 2,800,000 tons in 1899 to 8,700,000 tons in 1920. The per capita increase in the production of paper between 1895 and 1920 is 142 per cent; of pig iron, 91 per cent; of coal, 80 per cent. This great development has been brought about both by the increased use of paper and by the discovery of new uses for paper. More than eleven and a quarter billion copies of newspapers are now printed annually in this country.

Up to about 1900 paper mills were driven by steam engines through the agency of line shafts, belts, gears and pulleys. This type of drive involved a frictional loss of from 15 to 25 per cent of the energy of the engine, utilized a very large amount of floor space, involved dangerous hazards to the workmen, required a very great amount of maintenance and was limited in

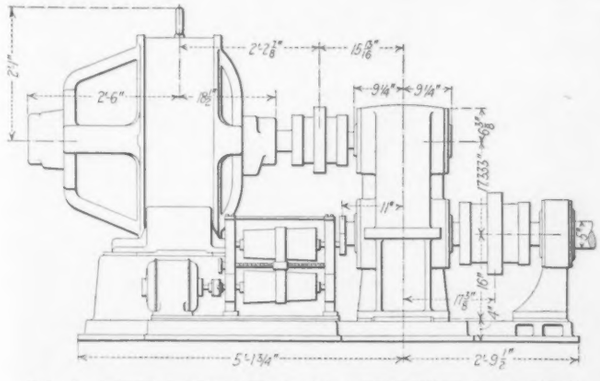


FIG. 1—TYPICAL DIMENSIONS OF A GEAR-DRIVE UNIT WITH SPEED-CONTROL MECHANISMS

magnitude, speed and control. The electric motor invaded the field and today several mills have installations of more than 15,000 hp. each and there is a tendency to increase the size of new mills.

Three-phase alternating-current motors are used almost universally except on the paper machine itself. For the pumps, Jordans and clippers the squirrel-cage induction motor has been found suitable, although the wound-rotor type is also used. For beaters, conveyors and large calenders the wound-rotor type of induction motor is popular, although recently the synchronous motor has been used with success to drive grinders and Jordans. It also has proved useful for the motor-generator sets used to supply direct current for the motors driving the paper machine.

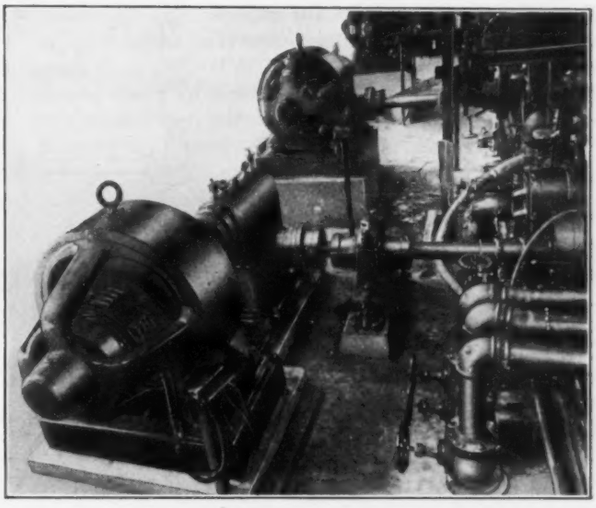


FIG. 2—A DRIVING-MOTOR UNIT MAY BE ARRANGED FOR DIRECT CONNECTION OR FOR STRAIGHT LINE OR RIGHT ANGLE GEAR DRIVE, DEPENDING ON SPACE AND SPEED REQUIREMENTS

The application which proved the great stumbling block in electrifying the paper mill was that to the paper machine. This machine consists of massive sections as shown in frontispiece, each section having an individual driving motor either directly or through gears. From a production standpoint it is necessary to control the relative speed of the driving motors within a fraction of 1 per cent, and in addition the whole mill must operate at different speeds, which are adjusted to the type of paper being made. These paper machines operate twenty-four hours a day for six days a week, and a shutdown may involve a production loss of from $5,000 to $15,000 for each day of lost operation. The maximum operating speed of a mill is about 1,200 ft. per minute and the minimum 200 ft. per minute. The limiting element in increasing the speed is the time required for forming the paper sheet before it enters the rolls and driers.

As the sheet of paper passes through the paper machine, it is dried and rolled, and the driving motors must be controlled to prevent the sheet being spoiled through its tendency to shorten or to lengthen because of temperature changes, variations in the grade of the paper and variations in load brought about by changes in bearing friction, paper thickness or paper breakage. The solution of this control problem is one of the finest examples of the ingenuity and inventive genius of American engineers.

Because of the speed and control requirements the

direct-current motor is best adapted to sectional drive. The war gave impetus to its development so that three distinct systems are now available—the Westinghouse and General Electric in this country and the Harland system in Canada. These different systems all use the direct-current driving motor but differ in the mechanical arrangements of the control system. In each system, however, corrective operation of the control is brought about by a tendency to a change in the relative speed of the mill sections.

TYRONE PLANT TYPICAL

As a typical example of the development of the sectional drive of one manufacturer, the paper mill of the West Virginia Pulp & Paper Company, at Tyrone, Pa., will be used. This mill has a 98-in. 250/500-ft. per minute Fourdrinier book machine with a sectional drive involving about 400 hp. in motors; and a 166-in. 250/500-ft. per minute Pusey & Jones book machine having a 600-hp. sectional drive installation. The whole mill has about 4,000 hp. in motors, each of the five Jordans being driven by a 175-hp. synchronous motor and the sixteen beaters being driven by wound-rotor induction motors.

About three years ago the Westinghouse Electric & Manufacturing Company made an installation of sectional-drive control equipment on a Crocker-Wheeler motor installation at the plant of the Gould Paper Company at Lyons Falls, N. Y. Following this development, a complete installation was made for the two machines at the Tyrone plant. In line with a policy of simplification and improvement, within the past few months the control equipment on the 98-in. machine has been completely remodeled, and this latest type is being used on new installations.

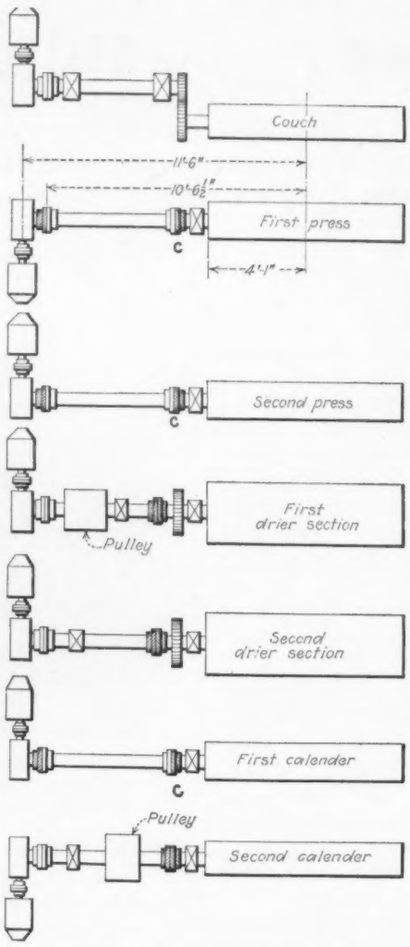


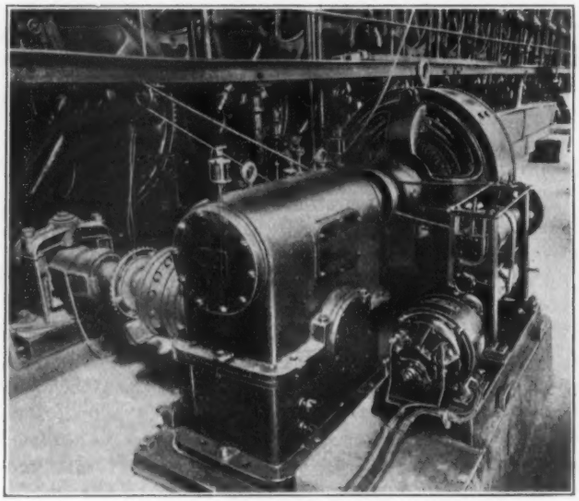
FIG. 3—A PAPER MACHINE WITH SECTIONAL DRIVE USING RIGHT-ANGLED GEARED MOTORS

The motors used in sectional drive are adjustable-speed, interpole, direct-current, shunt motors having both armature and field control. The starting torque requirement is very severe, and the motors must be designed with this in view. Upon starting, relays are used to give full field and armature resistance control. The drier motors may have dynamic braking in some installations and the calendar motors may be reversible. The motors may be directly connected or geared. In the Tyrone plant a right-angled worm-gear drive is used with Timken roller bearings.

A synchronous motor-generator set with directly connected exciter is used for the direct-current power supply for each paper machine. A motor-operated field rheostat in the field of the generator gives armature voltage control, and the exciter furnishes a constant-voltage direct-current supply for the driving-motor fields, which also have field resistance for control.

The armatures of all the motors are connected in parallel to the main direct-current buses, and through push-button control stations and the motor-operated field rheostat the voltage of this bus may be adjusted to give a required speed for the machine which is determined by the machine operator.

All motors on a machine adjust themselves to the speed required to conform to the load and applied voltage, but it is extremely difficult to design seven motors sufficiently similar in characteristics to change their speeds in the same ratio as armature voltage change and impossible to secure fixed relative speeds if



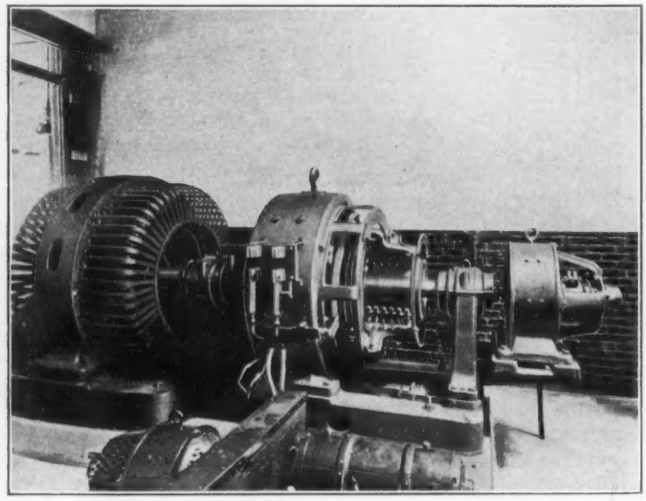
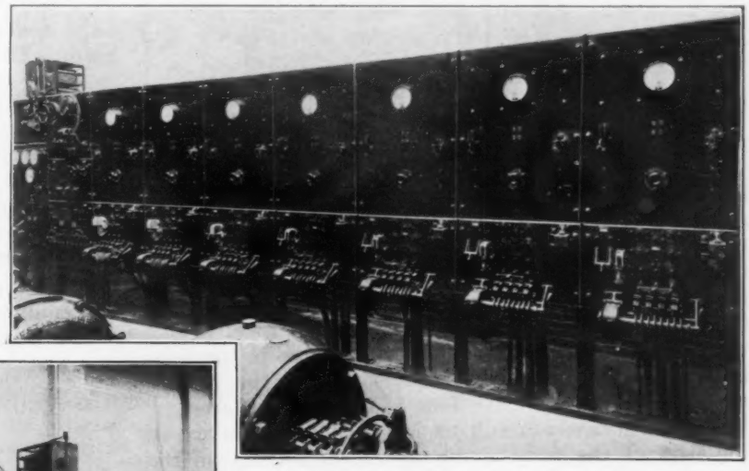


FIG. 4 (LEFT)—A DRIVING-MOTOR UNIT SHOWING CONE-PULLEY SPEED-ADJUSTING DEVICE AND SECTION COMMUTATOR SWITCH. FIG. 5 (RIGHT)—IN THE FOREGROUND IS A PART OF THE MASTER COMMUTATOR SWITCH WITH ITS DRIVING MOTOR. IN THE REAR IS THE SYNCHRONOUS MOTOR D.C. GENERATOR SET AND EXCITER FOR SUPPLYING ENERGY TO ONE PAPER MACHINE

TABLE I—INSTALLATIONS OF THE HARLAND ENGINEERING COMPANY IN CANADA

Company	Location	Machines	F.P.M.	Product
Laurentide Co.....	Grand'mére	Two 166-in.	1,000	Newsprint
Belgo Paper Co., Ltd...	Shawinigan Falls	One 232-in.	800	Newsprint
St. Lawrence Paper Mills, Ltd.....	Three Rivers	Two 166-in.	1,000	Newsprint
Interlake Tissue Mills, Ltd.....	Thorold	One 148-in.	100/500	Tissue and bond
Howard Smith Paper Mills, Ltd.....	Crabtree Mills	One 92-in.	80/400	Book and bond
Provincial Paper Mills Co., Ltd.....	Port Arthur	One 148-in.	100/500	Book and bond

the paper changes in thickness between machine sections. The problem was difficult because the relative speeds could not vary more than one-tenth of 1 per cent if continuous production of paper was desired. It was attacked by designing an automatic field control for each motor of the machine. The control mechanism for changing the field was the paper-machine unit itself; that is, a change in the speed of one unit relative to the speed of the other sections would actuate the electric control system so as to bring the speed of the individual unit motor back to synchronism. Fig. 2 shows a driving motor geared to the slow-speed shaft of a paper-machine unit. In the frontispiece illustration on page 1032 are shown the motors connected to the different units of the 166-in. machine at Tyrone. Fig. 3 shows a typical paper-machine layout with gear drive.



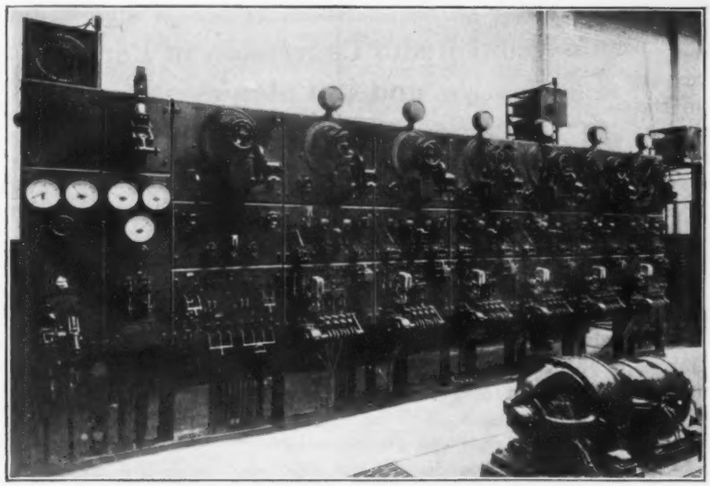


FIG. 6—VIEWS OF SWITCHBOARD PANELS FOR SECTIONAL DRIVE PAPER MACHINES

Upper view shows the new control board and the lower view the old. A marked simplification is noted on the new panel. The lower section of each driving motor panel on the new board contains the motor-starting resistance control, which is similar in the two systems. At the extreme left is the panel on the motor-generator power supply set. On each driving motor panel on the new board the field rheostat is locked in position and no movable parts appear.

Figs. 1 and 4 show views of a unit drive with the control equipment designed to secure a slight adjustment in the fixed speed of the unit relative to the others. A sprocket-and-chain arrangement from the motor-drive shaft is connected to the top cone pulley. This in turn is belted to another cone pulley, which in turn is connected to the automatic speed-control mechanism. A shift of the belt by means of a hand-operated device changes the relative speed of the top and bottom cone pulley, and this in turn actuates the automatic control mechanism to obtain a change in the speed of the motor driving the unit. This cone-pulley device is usually used when the paper machine is driven at several operating speeds and gives a range of about 30 per cent relative speed change.

The older type of automatic control indicated in Fig. 7, designed to care for incidental speed changes caused by the passing sheet of paper and successfully operating on the 166-in. machine at the Tyrone mill, has several contacts and moving parts. The small master-frequency generator is driven by a direct-current motor which is in parallel with the section-driving motors, and this small frequency generator requires alternating-current excitation. A section-frequency generator is driven by each section-driving motor through the cone-pulley speed-control set. The section contactor switch is a synchronous-type relay and makes contacts in one direction or the other when there is a difference in frequency between the section generator and the master generator. Upon the closure of the contacts a motor-operated rheostat in the field of the section-driving motor is energized and the field current varied to change the speed of the driving motor until the frequency generators are in synchronism. Thus in making paper the control will care for any changes in the relative speed of the sections. For each of the mill speeds this control is able to maintain automatically a fixed relative speed between sections. A master push-button station controls the starting and stopping of the paper machine and section push-button stations are used to control the starting and stopping of each unit of the machine.

In the newer type of control, illustrated in Figs. 2 and 8, the mechanical arrangement of the paper machine, adjustable-speed control and cone-pulley device are undisturbed, but the automatic control has been simplified greatly. The lower-cone pulley on each unit is connected to a rotating commutator switch (see Fig. 4), consisting of segmental rings, part of each ring being an insulator and part a conductor, and brushes. A portion of a similarly constructed master rotating commutator switch (see Fig. 5) is connected to the unit switch, and these two switches are in shunt with the shunt-field resistance of the driving-motor unit (see Fig. 8). Other portions of the master commutator switch are similarly connected through other segments to other unit commutator switches in shunt with the field resistances of each of

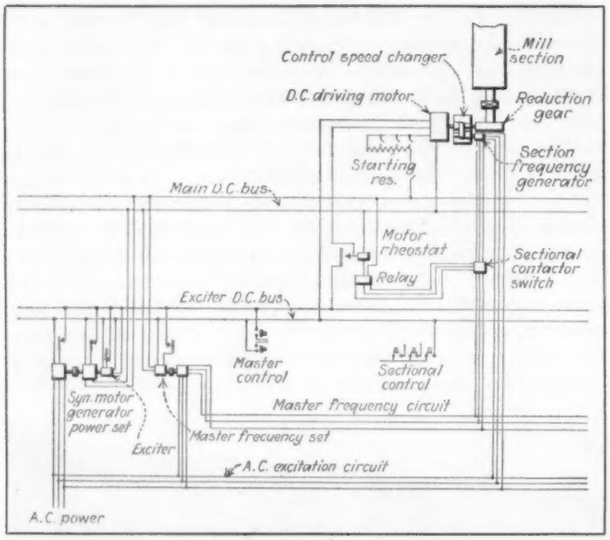


FIG. 7—SCHEMATIC DIAGRAM OF OLD CONTROL SYSTEM

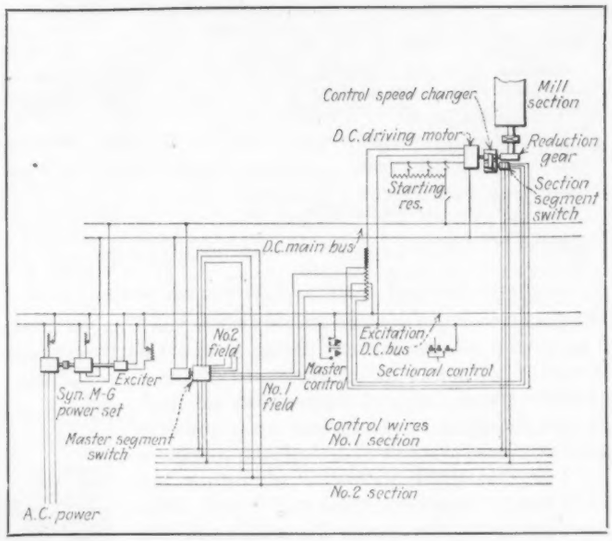


FIG. 8—SCHEMATIC DIAGRAM OF NEW MOTOR CONTROL SYSTEM

the other driving motors. The master commutator switch is driven by a direct-current motor whose armature is in parallel with those of the driving motors of the paper machine. Each unit commutator switch is driven by its individual paper-machine section through the cone-pulley device. Any change in speed of a unit of the paper machine thus causes a change in the relative positions of the segmental rings on the master switch and unit switch. This change in displacement is utilized to short-circuit or insert more resistance in the field of the unit-driving motor, depending on the direction of the speed change, and this causes the unit-driving motor to change its speed until synchronism again exists between segment displacements on the commutator switches. Several segments are used on each unit switch and the master switch in order to bring about a gradual change in field resistance. By a proper preliminary adjustment for each unit-driving motor the control circuits are arranged so that automatic speed of adjustments occur should the unit of the paper machine either decrease or increase its speed relative to the other units. The current carried in the control circuit is very small, and the speed of the commutator switches is on the order of 100 r.p.m., so that reliable operation can be obtained. The accuracy of the control is such that the relative speed change is limited to one-twentieth of 1 per cent. A comparison of the switchboards (Fig. 6) indicates the remarkable simplicity in the control system, and the solution of this problem has made possible the adaptation of the same principles and equipment to other industrial production processes where fixed relative speeds are required.

Marconi Radio Concession in Portugal and Its Colonies

THE Department of Commerce reports that the Portuguese government is authorized by a recent bill to contract with the Marconi Wireless Telegraph Company, Ltd., for a system of radio telephone and telegraph stations in Lisbon, the Azores, Madeira, Cape Verde and Angola, and Mozambique. The bill provides that this authority must be exercised within three months from date of approval so that all installations may be complete within four years. The Marconi company must bind itself to organize a Portuguese Radio Telegraph & Telephone Company, the board of directors of which shall be composed of six members, five of whom shall be Portuguese citizens. At least two-thirds of the capital of the new company shall be reserved for subscription in Portugal.

TABLE II—TYPICAL INSTALLATIONS OF THE GENERAL ELECTRIC COMPANY

Company	Location	Machine	Sections	Date
Crown Williamette Paper Co.	West Linn, Ore.	164-in. Bagley & Sewell	9	November, 1920
Bagley & Sewell, No. 1 (for Ontario Paper Co.)	Thorold, Ont.	164-in. Bagley & Sewell	9	November, 1921
Bagley & Sewell, Nos. 2, 3, 4 and 5	Three Rivers, Canada	164-in. Bagley & Sewell	9	April, May, June, August, 1922
Kimberly & Clark, No. 1	Niagara Falls, N. Y.	196-in. Pusey & Jones	9	1920
Kimberly & Clark No. 2	Niagara Falls, N. Y.	196-in. Pusey & Jones	9	On order
Mead Pulp & Paper Co., No. 1	Chillicothe, Ohio	152-in. Pusey & Jones	8	1921
Mead Pulp & Paper Co., No. 2	Chillicothe, Ohio	152-in. Pusey & Jones	8	1921
Spanish River	Canada	162-in. Pusey & Jones	8	1921
Consolidated Water, Power & Paper Co.	Wisconsin Rapids, Wisconsin	162-in. Beloit	10	July, 1921
P. H. Gletfelter Co.	Spring Grove, Pa.	170-in. Black & Clewson	..	On order
Kalamazoo Vegetable Product Co.	Kalamazoo, Mich.	164-in. Bagley & Sewell	..	On order

TABLE III—TYPICAL INSTALLATIONS OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

Company	Location	Machine	F.P.M.	Date
Abitibi Power & Paper Co.	Iroquois Falls, N. Y.	150-in. Pusey & Jones	400/800	May, 1921
Arrowhead Mills, Inc.	Fulton, N. Y.	144-in. Rice, Barton & Fabs	50/200	June, 1921
West Virginia Pulp & Paper Co.	Tyrone, Pa.	98-in. Fourdrinier	250/500	September, 1921
West Virginia Pulp & Paper Co.	.....	166-in. Pusey & Jones	250/500	September, 1921
Brown Co.	Berlin, N. H.	136-in. Bagley & Sewell	400/1,200	On order
Riverside Fibre & Paper Co.	Appleton, Wis.	116-in. Beloit Iron Works	150/600	On order
Washington Pulp & Paper Corp.	Port Angelus, Wash.	164-in. Bagley & Sewell	400/1,200	On order

Meaning of Inductive Co-ordination*

Consideration of the Conditions Which Are Encountered on Power and Telephone Systems in Actual Operation and Suggestions for the Practical Handling of the Problem

By J. C. DAMON
Engineer West Penn Power Company

THE problem of inductive interference is a mutual one, for power service and telephone service must be rendered to the same public at the same places, and the cost of both will be paid by the same ultimate consumers. In many new parts of the country there would be no use for telephones were the power lines taken away, and, on the other hand, telephones are so necessary to the operation of power systems that some large power companies maintain telephone systems of their own which compare well with the smaller public exchanges. In at least one state the largest single bill paid to the telephone company is paid by the power company.

The ideal basis for a co-operative solution would be that which a well-informed manager of both interests would adopt. Since both interests are not under one manager, the best which can be done is for both sides to become thoroughly well informed on the problem in all its aspects and to co-operate whole-heartedly. Since the fields of force cannot be escaped, engineers must work to control their effects.

Electrical Phenomena Met in Practice

Every conductor carrying a current or having a potential different from its surroundings is accompanied by a field of force. It takes energy to build up this field, and when it disappears energy is given back. This field of force can be visualized as in Fig. 1 for a straight conductor far removed from other objects. The magnetic field indicated by the concentric circles is proportional to the current, and the dielectric field indicated by the radial lines is proportional to the potential. This field theoretically extends to an infinite distance, but the intensity of either field in such an ideally simple case as that illustrated is inversely proportional to the distance from the conductor.

For every change in the current or potential a corresponding change occurs in the accompanying field. Every conductor within this field is affected by the change. This effect is called induction and is the basis not only of noise in telephones, but of every useful application of electricity which we know, except possibly electrolytic and heating actions, and these, if not dependent upon the surrounding fields, are nevertheless always accompanied by them. Without this induction, no transformer, motor, generator, condenser, magnet or vacuum tube would operate. The potential induced on a conductor through the dielectric field is opposite to that of the conductor inducing it. Any change of current in a conductor because of the accompanying change of magnetic field tends to cause an opposite change of current in any parallel conductor. These laws of nature are inescapable, but they can be partly controlled, and herein lies the real problem of ways and means of overcoming inductive interference.

There are two possible lines of attack:

1. To reduce or neutralize the fields of force.
2. To reduce or neutralize the induced potentials caused by a given field of force.

Fig. 2 illustrates the fields surrounding two parallel conductors carrying equal and opposite currents. In this case the fields are concentrated between the wires, but tend to neutralize each other, so that relatively little field exists at a distance. The closer the wires are to each other the more complete is the neutralization of the fields.

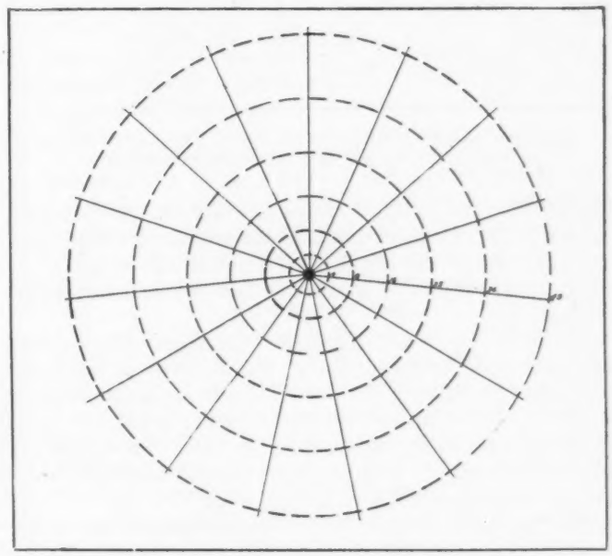


FIG. 1 — THE MAGNETIC FIELD AROUND A CONDUCTOR UNDER IDEAL SIMPLE CONDITIONS IS INVERSELY PROPORTIONAL TO THE DISTANCE FROM THE CONDUCTOR

The potentials induced in the two wires of a telephone circuit by a power circuit will be in the same direction and therefore would neutralize each other in the circuit if they were exactly equal in all respects. Because of the spacing of telephone wires they are in different parts of the field and usually have slightly different induced potentials which do not neutralize. A much more complete neutralization can be obtained by interchanging the relative positions of the two wires at intervals within the field, and this is the principle of transpositions.

A telephone conversation is a complex electrical phenomenon carried over the wires by waves of electricity in many different frequencies. Voice range (including harmonics) goes from about 100 cycles to 4,000 cycles per second, but the important range in the telephone is

*Paper presented at the fifteenth annual convention of the Pennsylvania Electric Association, Bedford Springs, Pa., Sept. 6-9.

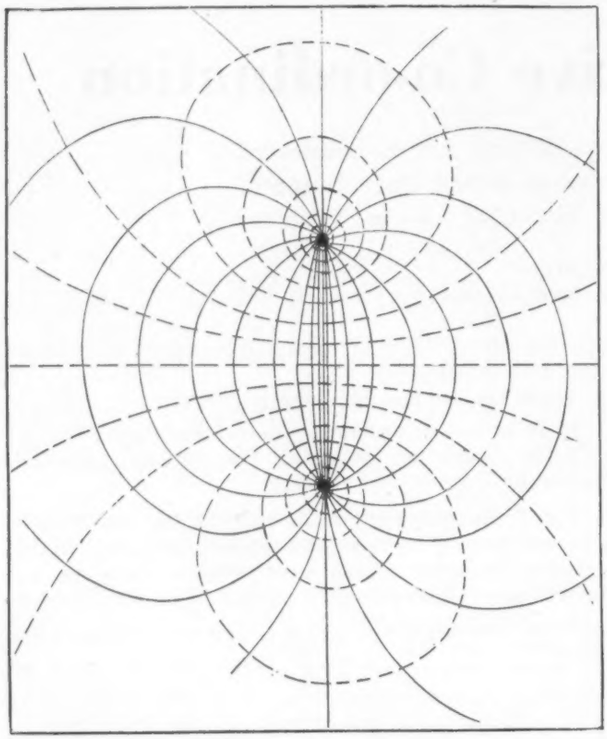


FIG. 2—FIELD OF FORCE SURROUNDING TWO CONDUCTORS CARRYING EQUAL AND OPPOSITE CURRENTS

from 200 cycles to 1,200 cycles per second. Any electric waves in this range induced in the telephone circuit and not neutralized will affect the quality of the voice, and if of sufficient intensity will make the conversation unintelligible.

To give an illustration of the magnitude of the currents used in telephoning, the current of an ordinary electric light is sufficient to make an audible noise in two or three million receivers of the usual type and in many more of the sensitive radio type. The inductive problem therefore involves very minute currents compared with those used in power circuits.

The ordinary transmission frequencies of 25 cycles and 60 cycles do not come in the voice range, and if power circuits involved only pure sine waves of these frequencies, the inductive-interference problem would under normal conditions be confined to telegraph and other low-frequency circuits. A pure sine wave would be represented as in Fig. 3. Sine waves of different frequencies combine with each other and make waves which are not sine waves. For instance, a pure sine wave and its third harmonic can be combined in different ways, two of which are illustrated in Fig. 5. In one case a flat-top resultant wave is caused and in the other a peaked wave. With different phase relations waves shaped still differently would result.

In a three-phase system—and this covers most transmission today—there are three fundamental waves traveling in three wires which reach their maximum at successive times as illustrated in Fig. 4. The algebraic sum of the three waves is always zero in a balanced three-phase system, and therefore they tend to neutralize each other. Such a transmission system of three sine waves with algebraic sum equal to zero would be perfectly satisfactory and effective for the transmission of power and would cause virtually no field of force which could disturb telephones. Unfortunately in the present state of the art and with materials available such pure sine waves cannot be maintained in any power system. For this reason power companies have often been accused of needlessly and wantonly disturbing telephone communication by harmonics which they did not need or use.

Harmonics come principally from three sources:

(a) Details of machine design, such as slots, pole edges, commutation, etc.

(b) The iron in transformers, especially when worked at high densities.

(c) Arcs as in arc lamps, electric arc furnaces, etc.

Practically only odd integral harmonics occur. These are observed up to the thirty-fifth, but are of very small magnitude above the nineteenth or twenty-first. The harmonics up to the thirty-fifth are shown in Table I for 60-cycle and 25-cycle systems. All the 60-cycle harmonics come within the voice range, and all the 25-cycle harmonics except the third do likewise. Only the fifth to the twenty-first harmonics of 60 cycles and the ninth and higher harmonics of 25 cycles come in the more important range for telephones.

There are other factors which determine the importance of various harmonics. The telephone receiver now in common use is not equally sensitive to all frequencies. Considering a 60-cycle system, the telephone receiver is fourteen times as sensitive to the third harmonic as to the fundamental and 110 times as sensitive to the ninth harmonic. Its maximum sensitiveness comes between 900 cycles and 1,000 cycles.

Another important factor is that under like conditions the current induced in a parallel circuit by a given current is proportional to the frequency. That is, if a current of 1 amp. in a power circuit at 60 cycles would induce 1 milliampere in a neighboring circuit, then 1 amp. at 900 cycles would induce fifteen times as much current, or 15 milliamperes, in the same neighboring circuit. This, taken with the sensitiveness of the receiver, would make the effect on the receiver 1,700 times as great as that produced by a current of 1 amp. at 60 cycles.

In a three-phase system the triple harmonics—that is, the third, ninth, fifteenth, etc.—are especially im-

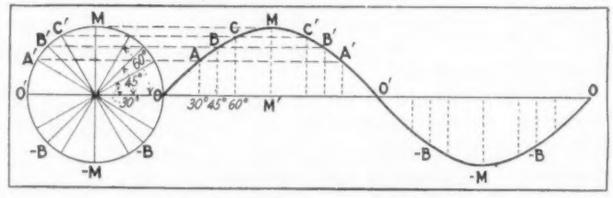


FIG. 3—THE PURE SINE WAVE

The ordinates represent time and the abscissas voltage or current, as the case may be. The part OO'O represents one cycle. In a 60-cycle system OO'O would be one-sixtieth of a second and the wave would be the fundamental of that system. just as in music the waves of higher frequency are called harmonics (the wave of double frequency would be the second harmonic and that of three times the frequency the third harmonic and so on).

portant. The triples of all three phases are in phase (as is shown for the third harmonic in the small waves of Fig. 5) and reinforce each other instead of neutralizing each other.

In an isolated neutral three-wire, three-phase system the triple harmonic currents have no return path and are therefore limited to the small current to charge the electrostatic capacity of the system to ground, but

third harmonic potentials appear out on the line. In this case, therefore, there will be little magnetic induction but there may be some dielectric induction. On the other hand, with a three-phase, four-wire system or with more than one grounded neutral there is a good return path through the neutral, and triple harmonic currents will flow with relatively low voltage, causing magnetic induction but little dielectric induction. Unneutralized currents and voltages like the triple harmonics are called residuals and are the main sources of induction. There are other causes of residuals, such as unbalanced loads, unbalanced capacity of line wires to each other and to ground, unbalanced inductance and unbalanced resistance.

The power man can do relatively little with existing systems to reduce the residuals and their fields of force except to maintain the system in good balance and in good order, but as changes are made and the system is added to he should be on the watch to improve his conditions. He should specify close adherence to a sine wave at all loads for his generators. Just how close will depend upon the type and speed, but manufacturers can in many cases do better than the requirements in this respect. Transformers should not be worked above normal voltage and as far as possible should use delta connections so as to shunt out triple harmonics. Where three-phase transformers are used star-connected with grounded neutral the core type tends to suppress triple harmonics and is therefore preferable to the shell type, but in spite of this a third winding, connected in delta, may be needed to suppress triple harmonics satisfactorily.

TABLE I—THIRD TO THIRTY-FIFTH HARMONICS FOR 25 CYCLES AND 60 CYCLES

Harmonic	60 Cycles	25 Cycles	Harmonic	60 Cycles	25 Cycles
Third	180	75	Twenty-first	1,260	525
Fifth	300	125	Twenty-third	1,380	575
Seventh	420	175	Twenty-fifth	1,500	625
Ninth	540	225	Twenty-seventh	1,620	675
Eleventh	660	275	Twenty-ninth	1,740	725
Thirteenth	780	325	Thirty-first	1,860	775
Fifteenth	900	375	Thirty-third	1,980	825
Seventeenth	1,020	425	Thirty-fifth	2,100	875
Nineteenth	1,140	475			

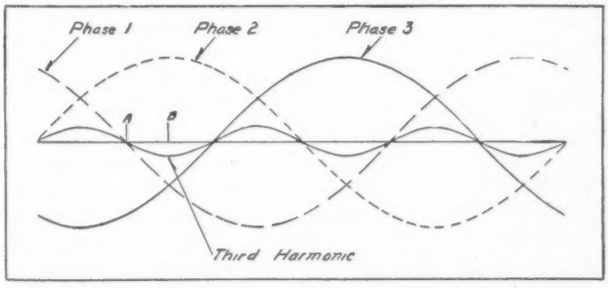


FIG. 4—FUNDAMENTAL WAVES AND THIRD HARMONIC IN A THREE-PHASE SYSTEM

The triples of all three phases are in phase and reinforce in place of neutralizing each other.

The configuration of lines should be chosen to give as good balance as possible. Uniform spacing of conductors throughout the line is always desirable. For single-circuit lines the equilateral triangle gives the best balance, and flat spacing with two wires on one side of the pole and one on the other is the worst. The isosceles and right triangle spacings are intermediate. The separation of the wires has little influence on the effect of residuals, but does influence the field owing to balanced components. Excessive spacing should therefore be avoided, but there is no object in crowding the wires together. Grounded sky wires have a shielding effect on residuals, but they may in some cases unbalance the capacity of the different wires so as to increase the residuals.

Transposing the power line does not itself reduce the effect of residuals, but such transpositions tend to balance the line and in this way to reduce the residuals. It is therefore advisable to have at least one "barrel" in each transmission line of any length, but frequent transpositions are not necessary. A "barrel" is where each wire successively occupies all three positions for equal distances. Two transpositions will, therefore, give a "barrel." Where telephone lines parallel power lines the transpositions in the two lines should be coordinated. For double-circuit lines the best configuration is to have each circuit vertical. The middle wire may be offset either way from the vertical without detriment as shown in A (Fig. 6). The balance of different configurations of double-circuit power lines will be the best, and therefore give the lowest residuals, if the phases are cross-connected as shown in B (Fig. 6). Within the length of a parallel with a telephone line the cross-connection which will give the least inductive field may be different from that shown in B (Fig. 6), but it will vary with the other conditions.

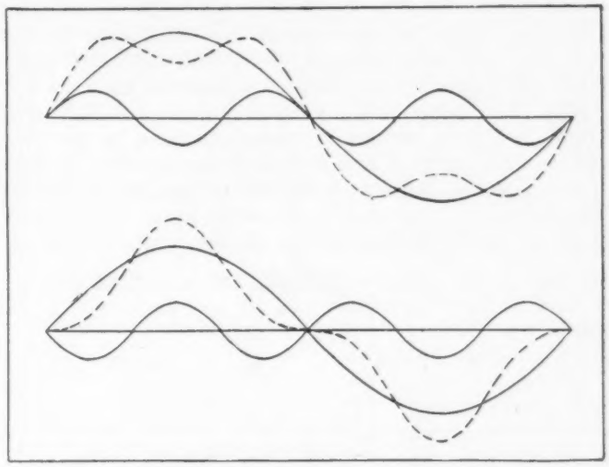


FIG. 5—TWO OF THE WAYS IN WHICH A PURE SINE WAVE AND ITS THIRD HARMONIC CAN BE COMBINED

When the power man has taken all the precautions he reasonably can, the fields of force going out from his lines will be very small compared with the energy he is transmitting, but they will still be very powerful compared with the fields of force going out from telephone lines, and it will be possible with instruments and arrangements now known to detect them many miles away. These fields of force cannot be eliminated or avoided, but fortunately their effects can be neutralized.

If a telephone circuit were perfectly and uniformly balanced as to resistance, inductance, capacity and insulation, and transposed so that the average location of the two wires were the same, it would be immune to external fields. It is only by approaching quite closely this ideal condition that telephones are operated over lines strung on the same poles with very high-voltage transmission lines.

Perfection is not attained by human agencies, and

therefore consideration of the effect of various factors will be enlightening. Resistance balance can be commercially obtained to a very close degree as the art of wire manufacture is highly developed. It requires some supervision over the making of joints and the use of uniform wire. It is not sufficient to have the total resistance of the two wires the same, but the distribution of the resistance must also be the same. The inductance of the two wires of a circuit is usually the same provided that they are of the same material and are not unequally exposed to outside magnetic material. The capacity of each wire depends upon its distance from other wires, ground and grounded objects. It is, therefore, harder to control, but can be balanced by uniform spacing and sufficient transpositions. Getting insulation balance is largely a question of getting the insulation resistance sufficiently high. It is necessary to have the distribution of the insulation resistance the same, as well as the total insulation resistance of each wire.

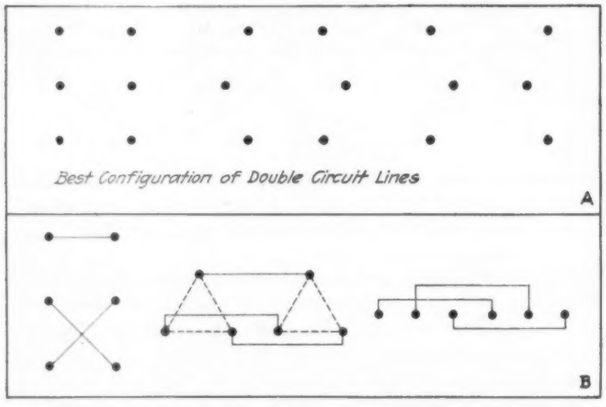


FIG. 6A — BEST CONFIGURATION OF DOUBLE-CIRCUIT LINES; FIG. 6B—CROSS-CONNECTION OF PHASES ON DOUBLE CIRCUIT LINES THAT ARE BEST AND GIVE LOWEST RESIDUALS

Terminal apparatus, loading coils, etc., connected into the circuit must also be balanced in the same respects as the lines. These can be subjected to routine tests in manufacture and are not suitable for use unless properly balanced. On subscribers' circuits some arrangements are in common use which are not balanced, and ground connections are made which do not connect to neutral points. These circuits are not immune to outside fields, but fortunately are usually short and little exposed. They are not suitable circuits for use where exposed to interference. The induction in telephone circuits is roughly proportional to the length exposed to an outside field, to the strength of the field, to the frequency of alternation of the field, to the spacing of the wires of the telephone circuit and to the unbalance of the telephone circuit. The last two items are controllable only in the telephone system.

If only two wire metallic circuits connecting two stations together were in use, the problem of inductive interference would be relatively simple, but the amount of wire required to serve the subscribers on this system would be enormous. For this reason phantom circuits are used and telegraph circuits are operated over telephone lines. Four telephone wires will make two metallic circuits and one phantom as illustrated in Fig. 7.

The two metallic circuits are called side circuits, and the circuit obtained from the middle or neutral points of impedances or transformers across the side circuits is the phantom. By connections through impedance coils or transformers and condensers from these same neutral points to ground two telegraph circuits can be obtained. By putting impedances or transformers across the phantom circuit a third telegraph circuit can be obtained. Thus four wires will permit three conversations and three telegraph circuits, which, if quadruplexed, would mean six telegraph messages each way, all at the same time. If high-frequency carrier currents are used for telephoning, the number of telephone conversations can be multiplied three or four times. All these messages will go through without interference or getting mixed up, provided everything is balanced and properly adjusted. Such achievements are wonderful and reflect great credit on the ingenuity and ability of the telephone engineers. They also show that it is entirely feasible to maintain close balance and thorough transposition systems in telephone lines, for such schemes will not work without them. On the other hand, observe how completely a system like that covers the range of frequency which has been involved in power supply systems these many years. The telegraph is affected by the fundamental and lower harmonics and the telephone by the other harmonics up to quite high ones, and then it is but a step to the frequencies employed for the carrier currents.

Covering such a field, the logical place to neutralize outside disturbances is in the telephone circuit. There are very great advantages in doing this, for at the same time the effect of atmospheric electrical disturbances, induction from other telephone lines, induction from telegraph lines and noise from the many uses of one circuit are all cured at the same time.

The separation of the wires of a telephone circuit in accordance with standard practice on a ten-pin arm is desirable because it keeps down the electrostatic capacity between the wires and helps transmission. However, the induction being proportional to the spacing, it is one of the most important contributing causes of interference. The pole-pin circuit has one and a third times as wide spacing as the other circuits and should pick up that much more noise. The spacing of a phantom circuit is equivalent to the distance between the centers of the side circuits, which is 24 in. The phantom should therefore be expected to be twice as noisy as a 12-in.-spaced side circuit under like conditions of balance.

It is therefore evident that whenever so many thousand or hundred noise units are reported as created in a telephone line by power lines it is necessary to know in addition the balance of the telephone line and whether it is a side, a phantom or a pole-pin circuit.

Having seen that there are two sides to the inductive-interference problem, it is worth while to review the practical handling of it. In the past court records and commission rulings on such cases fill volumes, and the decisions range from one extreme to the other. Very little constructive progress has been made in this way, but today the National Electric Light Association and the largest telephone interests are getting together in a manner that bids fair to radically improve these conditions.

The greatest constructive work toward the solution of the inductive-interference problems up to the last year was that of the California Joint Committee of

Power and Telephone Interests, whose final report was published in 1919. The technical work of this report was enormous. A large share of it was done by the splendid organization of the American Telephone & Telegraph Company, and the final draft of the report was largely drawn by these engineers and in the spirit which grew up against the court and commission method of settling problems. This report is summarized under seven guiding principles for preventing interference:

1. Avoidance of close proximity.
2. Elimination or suppression of harmonics.
3. Limitation of residuals.
4. Reduction of intensity of induction by favorable arrangements of conductors.
5. Neutralization of induction by co-ordinated transposition systems.
6. Balancing of metallic communication circuits.
7. High-grade construction and care in the operation and maintenance of power circuits.

Principle 1 above is emphasized by the statement: "By no other means can complete freedom from interference be obtained." While not detracting from the excellence and value of the report in general, this is a wrong guide. The same people want and will have both services at the same place, and if they come over long distances they must often follow the same routes. In the ideal case shown in Fig. 1, the fields of force are reduced in proportion to the distance from the conductors, but in the more complex practical cases the inductive effects vary under different conditions from inverse proportion to the distance to inversely as the third power of the distance. Taking an average, or inversely as the square of the distance, it is evident that the benefit of separation falls off rapidly. With 10 ft. separation a further separation of 10 ft. would quarter the inductive effect, but when 1,000 ft. away it takes a further separation of 1,000 ft. to get a like reduction. Miles of separation of long parallels will not give complete freedom from interference unless other conditions previously outlined are fulfilled. If these other conditions are fulfilled, wide separations are not necessary, even though desirable.

In many cases the only avenues of approach to the consumers of both services are the highways and both must use them. To make separation the primary principle of the solution of the inductive-interference problem is to fly in the face of progress, for the tendencies of the times are to greater density of population and more universal service. Joint-pole construction and not separation will be the line of future development, and economic forces are already pressing hard in this direction.

The second and third principles are to be applied wholly to the power systems. The fourth and fifth involve both systems and serve to emphasize the fact that the problem is mutual. It must be noted, however, that the telephone systems have not made the slightest change in their configuration or spacing for the reduction of interference, notwithstanding the fact that phantoms which now pick up the most noise because of double spacing could be so arranged as to have an equivalent of nearly zero spacing.

The sixth principle is the only one applying to the communication system alone, and the telephone engineers have made thorough studies and developed wonderful methods for measuring the factors involved. They get marvelously close balance on some of the longest circuits. However, in many cases of inductive interference this factor is wholly neglected. The power man in his own interests should understand the importance of balance in telephone circuits and see that it is not neglected wherever his circuits are concerned in inductive interference. Not only the circuit as a whole should be balanced, but each section of the circuit should be balanced within itself. It is both futile and unjust to make expensive changes in power circuits for a small reduction of interference when a large reduction could be obtained at less cost by balancing the telephone circuit. The telephone circuit using one wire and ground is 100 per cent out of balance and is not suitable for use in regions where the public is to have power service. The seventh principle as stated applies only to power circuits, and the text gives as the reason for this principle the severe momentary disturbances in communication circuits during abnormal conditions in the power circuits. It can easily be appreciated that the telephones, which are operated by a few thousandths of a watt at the most, can hardly be made immune to the thousands or even hundreds of thousands of kilowatts that can surge unbalanced in a large power system under abnormal conditions. For this reason, as well as for the protection of his own service, the power man should spare no effort to prevent such conditions and to limit their duration when they are unpreventable.

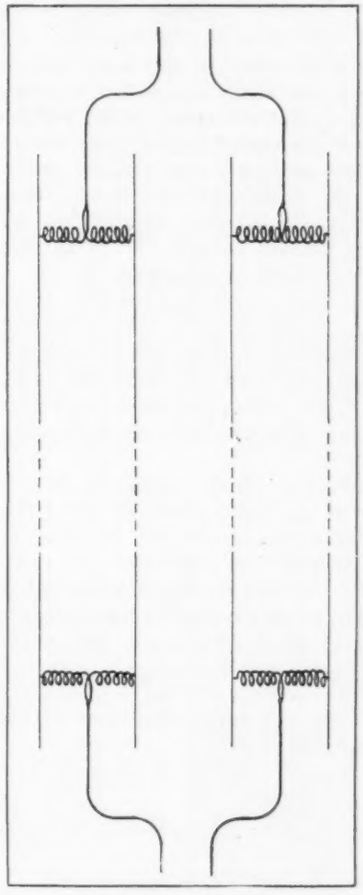


FIG. 7—METHOD OF MAKING UP PHANTOM TELEPHONE CIRCUIT

There is no less obligation, however, upon the telephone men to use equal care in the construction, operation and maintenance of their circuits. The one-sided statement of the seventh principle has prevented it from accomplishing the greatest good.

The fact that inductive interference problems must be mutually solved is being more clearly recognized every day, and the joint work now being done by the National Electric Light Association and the American Telephone & Telegraph Company bids fair to give courts and commissions much relief and to solve the problems as they primarily must be solved—by the engineers of the two interests. The closer the touch maintained between the power and the telephone engineers the more easily will the difficulties be overcome.

Transmission-Line Construction in Japan

As One Result of the Rapid Development of Water Power the Art of Transmission Has Become Highly Specialized—Thirteen Lines, Four Carrying 154,000 Volts, Will Serve Tokyo and Osaka

By ERNEST V. PANNELL
Engineer British Aluminum Company, New York

PROBABLY no country in the world is converting potential water power into electrical energy at so great a rate as Japan. Water-power rights are vested in the state, and the various prefectures have authority amounting to a veto at the discretion of the governor; nevertheless these facts have not acted as a hindrance to the free and logical development of natural resources. As an illustration, one large power company supplying the city of Osaka is already operating four plants producing 40,000 hp. and is developing nine other sites which will yield 250,000 hp. additional, most of these sites being now under construction and scheduled for operation within the next two years. This system is one typical of at least half a dozen power networks in a similar state of development.

In general the watershed which forms the Sierras of Japan lies along the northern shore of the island and the industrial cities are on the south. Chief among the latter are Tokyo (population 2,500,000) and Osaka (population 1,500,000). Power developed in the mountains is therefore carried across the central plain in a southerly direction to the seaports and the centers of industry, and the transmission-line art has been highly developed. The following are the principal systems operating high-tension transmission lines to supply the two principal cities:

TOKYO	Kv.
Tokyo Electric Light Company	154
Keihin Electric Power Company	154
Inawashiro hydro-electric development	110
Gumma Electric Power Company	110
Katsuragawa hydro-electric development	77
Kinugawa Electric Power Company	77
Fuji Gasu Power Company	66
OSAKA	
Nippon Electric Power Company	154
Daido Electric Power Company	154
Ujigawa Power Company	77
Taisho Water Power Company	77
Kansai Water Power Company	77

The four 154-kv. lines mentioned above are now under construction, together with a power line of similar voltage in the island of Formosa, this figure of 154 kv. having been adopted as a standard. Transmission distance for the longest lines does not generally exceed 150 miles, but, with the present tendency to interconnection, a great number of power sources and receiving points are tied into a network so that the average distance of transmission is reduced. Any group of public utility corporations may be compelled to merge where it is in the interest of the general public, the decision in such a case being given by the Department of Communications. This is a federal department of considerable authority and also of considerable utility because it is concerned with railroads, telephones and telegraphs and also with power transmission. The department can therefore co-ordinate conflicting interests in such matters as telephone interference and crossing construction; indeed, the first-mentioned consideration has been responsible for the wide use of delta high-tension connections or, alternatively, of a relatively high resistance in the ground connection of a Y system.

In addition to the groups of systems above mentioned, extensive power networks are in operation or under construction in the islands of Kiushiu, Shikoku and Formosa. The Shikoku power centers are expected to be tied in with a 400-mile superpower network linking Osaka with Moji and there connecting with the Kiushiu systems. In the near future also a very extensive power development on the Shinano River will be made by the Imperial Japanese Railways, now in course of being electrified. This will involve transmission at 154 kv. and at lower voltages also.

GOVERNMENT SUPERVISION EXISTS

Pole and tower line design is based upon the recommendations of the Department of Communications not only as regards crossings but in relation to the entire line, whether on private right-of-way or not, and all designs have to be submitted to the department as well as to the local prefecture for approval. The loading assumptions are of two kinds, depending upon whether or not the district is subject to sleet: (a) Wind load of 20 lb. per square foot on projected area of wire, no sleet; (b) wind load of 10 lb. per square foot on projected area of wire, ½ in. sleet.

In districts where sleet does not prevail it is seen that a higher wind load is calculated upon. For the conductors a maximum stress of one-half the ultimate figure is allowed, with the following minimum specifications for tensile strength:

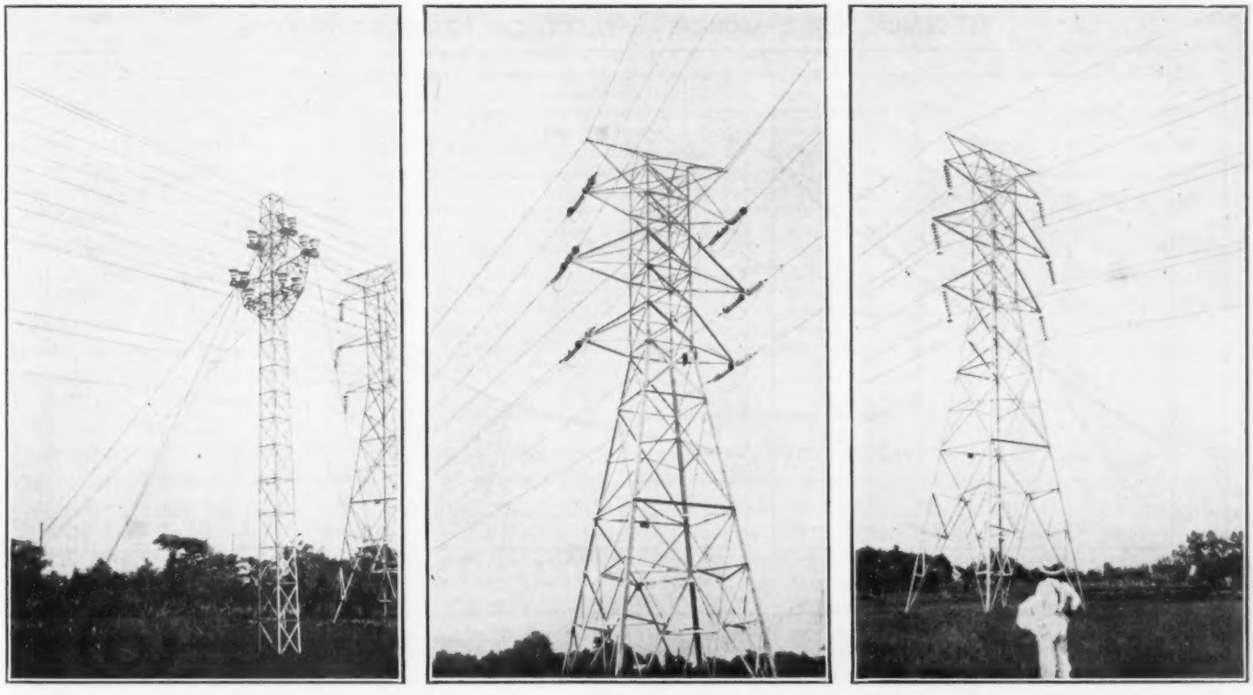
	Lb. Per Square Inch
Copper, hard-drawn	50,000
Copper, annealed	30,000
Aluminum	23,000
Iron	50,000

Steel-cored aluminum is being extensively used on practically all the new power lines, especially in the mountain districts where the corona disruptive voltage is low. The tensile strength of this material varies with the make-up of the cable from 40,000 lb. to 50,000 lb. per square inch. Investigation is now being made by the department with a view to establishing its properties. There is a tendency not to string aluminum-steel conductors as tightly as copper because a small sag can be realized with a lower tension and tower steel can be saved. At the same time there are many long river crossings where it is desirable to work up to 50 per cent of the ultimate tensile strength of the cable.

Wooden-pole lines are extensively used, the most typical construction consisting of two poles braced together with steel channel cross-arms and three pin-type insulators for a single 77,000-volt circuit. The spans are from 300 ft. to 400 ft. and the poles are guyed at angles. A special design for crossings is required by the Department of Communications. In this case there are two insulators for each wire. A short additional length of cable is tied to the extra insulator and securely joined to the main cable on each side of the pole about 3 ft. out. In this way if an insulator flashes over and the wire is burned off, it cannot fall in the road, because the other insulator will hold it. The same construction is used both for highways and railroad crossings. For wooden poles the design loading calls for a wind pressure of 24 lb. per square foot of projected surface at right angles to the line, with a safety factor of five on the pole.

Present construction is of steel in nearly every case, and for 110 kv. and more suspension insulators are used, but there is a strong tendency to perpetuate the use of pin-type insulators for line voltages up to 77,000. Tower steel is fabricated in Japan, but a number of orders are placed with American concerns because in most cases their designs are better. In Japan the shops are not laid out especially for tower work, but for general structural designs; consequently they are not equipped with the templates and shearing and punching machinery for the many small members required in a transmission tower. For the same reason Japanese towers use a number of gusset plates and what would be considered in America unnecessary members. The subject of transmission-tower design is being very carefully studied in Japan, and a series of experimental tests on full-size designs is being carried out at the Kyoto Imperial University under the supervision of Prof. E. Aoyagi.

Insulators are made in Japan by the Nippon Insulator Company, at Nagoya, the historic center of the porcelain industry, and by the Shofu Insulator Company at Kyoto. Both of these companies produce the metal-cap form of suspension unit in addition to the large pin-type units for 66 kv. and 77 kv. Most units are of white finish, as it is believed to be easier to locate a defective insulator by its discoloration. A large number of insulators are imported from America, and it is a common thing to see American and Japanese insulators hung on different circuits on the same tower. No grading shields have yet been employed, but experiments have been made with a ring-shaped device, and it will probably be used on one of the 154-kv. lines now being built. Insulator hardware is made in Japan, but there is a certain amount of dissatisfaction resulting from the use of malleable iron fittings, and Japanese shops are not as yet equipped for drop-forging these products. The climate of Japan is for the most part very moist, and galvanizing has therefore a very short life. In many parts of the country it would be better to paint the towers and fittings, because the rapid deterioration constitutes a distinct hazard.



LEFT—STEEL TOWERS ARE GUYED TO WITHSTAND ABNORMAL STORM CONDITIONS ON THE LINES OF THE TOKYO ELECTRIC LIGHT COMPANY. CENTER—A TOWER FOR A 6-DEG. HORIZONTAL ANGLE ON THE LINE OF THE INAWASHIRO POWER COMPANY HAS 50-LB. BALANCING WEIGHTS. RIGHT—ANCHOR TOWERS ARE USED EXTENSIVELY ON THE LINES OF THE INAWASHIRO POWER COMPANY

One feature of the line design used is well known to all engineers who have been concerned with construction in mountain districts. The steep profiles necessitate in places towers at widely different elevations involving a "pull-up" at the lower suspension point. "Tie-down" insulator strings have been used on the lower tower at such locations, but the usual troubles have been experienced with flashing over and rapid deterioration of the lower insulator, so that the tendency now is to use weights at such a point, in this way maintaining the flexible characteristics of a suspension insulator line. The same procedure has been adopted where a suspension tower is used for small deviations from alignment to prevent the insulator swinging in and

grounding the wire on the tower frame. Indeed, in one case weights are now in use after the towers have been modified by the addition of an extra bracket for use with tie-down insulators.

Construction work in the field is influenced by the fact that for the most part the terrain is swamp or mountain. For this reason and because the standard of proficiency is very low among the laborers towers are built up from the ground piecemeal, three men being able to complete a 4,000-lb. tower in a ten-hour day if the conditions are good. The stubs are, of course, set first, generally in concrete. Most of the tower lines run across the paddy fields, which are in a semi-liquid condition during most of the year, and this condition, together with the frequent earthquakes, has been responsible for the subsidence of foundations on some of the older tower lines. This has been corrected by guying in several places to patent anchors driven deep enough to reach solid ground. In some more serious cases the tower members have been braced with timber as a reinforcement against distortion.

SOME TOWERS ASSEMBLED ON GROUND AND HOISTED INTO PLACE

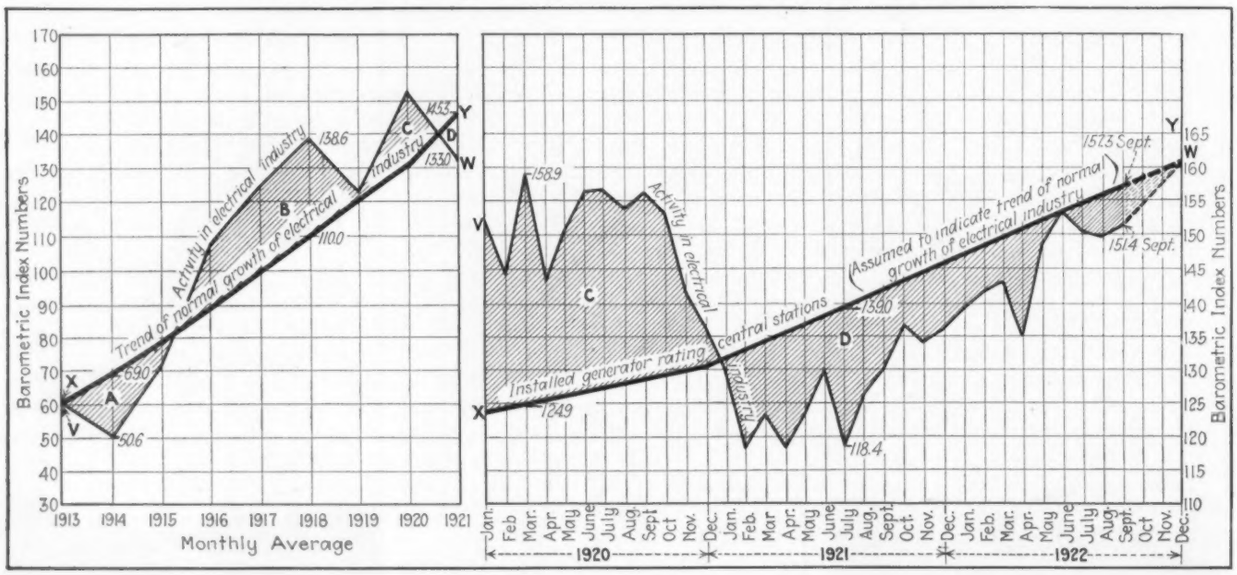
In a few isolated cases towers have been assembled on the ground and afterward hoisted into place. Owing to the difficulty of using a team or a truck, a capstan has been set up and the fall of the lifting tackle connected to it. Then a dozen men have taken the capstan bars and raised the tower to the sound of the invariable chanty. A windlass has been used for wire stringing, but the result has not been so satisfactory, and it is more usual to strain up entirely by manual tension with the usual tackle and dynamometer. As a field crew consists of at least twenty-five to thirty men, there is plenty of power available of an unskilled type and at a comparatively low cost.

The illustrations printed with this article relate to a double-circuit 110-kv. line recently built from Kanai to a point near Tokyo, a distance of 83 miles. The average standard span is 600 ft., with a river crossing of 1,300 ft. Six conductors and two ground wires are installed, with a 10-ft. vertical spacing. Five different types of tower are employed for horizontal angles of 6 deg., 15 deg., 30 deg., angle suspension and tangent and angle anchor towers. The weight of the towers varies from 5,700 lb. to 13,000 lb. Most of the footings are concrete.

Settlement of Strikes Brings Industrial Progress

INDEX figures upon which the "Electrical World Barometer of Business Conditions in the Electrical Industry" is based indicate that September activity within the industry as a whole was the highest since June, the record month of 1922. The continued coal and railroad strikes took their toll from American industry during July and August, but early September witnessed the termination of both of these retarding forces, and there was a subsequent increased activity in many primary industries during the later part of that month.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



The "Electrical World Barometer" indicates that during the month of September business conditions in the electrical industry, taken as a whole, showed an increase of 1.4 points in the barometer scale as compared with August. The electrical industry as a whole during September was operating at 5.9 points below what would have been the point of seasonal demand if growth in the industry had been normal. In August it was operating at 6.0 points below the point of normal demand.

It must be remembered, however, that the electrical industry is essentially a growing industry. The fact, therefore, that activity in the industry during September was virtually the same number of points below the point of normal demand as in August does not necessarily mean that production and sales of electrical energy, machinery and supplies were on a par with those of August. During this one-month period thousands of new customers, both lighting and power, were undoubtedly added to the central-station lines, thereby increasing the market both for electrical energy and for apparatus. This increased market must be considered as to a large extent permanent.

Changing Two-Phase System to Three-Phase

T-Connected Auto-Transformer on Buses Allows Easy Transition as Existing Equipment Wears Out—Interconnections in Two-Phase Machines Must Be Removed

By J. F. PRITCHARD
Electrical Engineer, Kansas City, Mo.

ALTHOUGH three-phase service prevails in the larger number of communities in the United States, there are still a great many installations, particularly in the smaller towns or cities, where it has not been possible to change installations that date back to a day in the development of the industry when two-phase service was a common thing. A real problem faces the companies, brought on by the developments which at the present time seem to have made the three-phase system all but standard. Manufacturing processes are being refined, and the tendency to cheapen these processes by eliminating a large number of types of apparatus that belong to the older developments is either making it difficult to get needed apparatus promptly or in some cases is imposing an extra cost because apparatus is not considered standard. This is a natural tendency in industry forced by economic considerations. This article offers a suggestion for changing two-phase systems to three-phase that does not involve scrapping of present investment except as it wears out in the natural course of service. The method has been successfully used in several cases and is worth careful consideration.

THE advantages of a three-phase over a two-phase system for transmission, distribution and utilization of power are too well known and recognized to necessitate reviewing here. Undoubtedly a large number of power companies now operating two-phase systems have contemplated changing to three-phase but have abandoned the idea after the first consideration of what appeared to be a large investment in new equipment, extensive new construction, new temporary feeders, rewinding machines and other items. It is the purpose of this article to describe a plan for changing a system from two-phase to three-phase with a minimum of expense and no interruptions of circuits or temporary work.

This system was developed and first used under the supervision of the writer in connection with the conversion of the electric power system at Ardmore, Okla., to three-phase. It was subsequently used under similar conditions in the municipal plant at Ottawa, Kan., under the direction of Prof. George C. Shaad of Kansas University. However, since each case presents individual problems, it is the purpose of this paper to discuss in a general way the conversion of a representative plant of this nature, rather than to describe in detail any particular set of conditions.

Two T-Connected Auto Transformers Are the Basis of Scheme

The principle of the plan consists of interconnecting the two-phase buses with a pair of T-connected auto-transformers. The original two-phase buses can be represented in Fig. 1, where the letters on the bus diagram correspond to those on the vector diagram, the system consisting of two single-phase voltages, *AB* and *CD*, at a phase displacement of 90 deg. By interconnecting the two-phase buses with the T-connected auto-transformers we have the condition shown in Fig. 2. The 50 per cent point of voltage *AB* is connected to the 86.6 per cent point of voltage *CD*, throwing the two voltages into such phase relation as to produce a three-phase system between points *A*, *D* and *B*. We therefore have the condition in which we have a two-phase system *AB* and *CD* and a three-phase system *ABD* on the same four busbars. It should be noted that this applies only to an independent two-phase system, and that if the phases are already interconnected, as, for instance, at their midpoints, as is the case with some generators, they must be disconnected before the phases can be T-connected, for it is evident that the two phases cannot be interconnected at point *E* if already interconnected at some other point.

What is true of the relation of phases on the station buses of course also applies to the feeder circuits and primary distribution circuits throughout the system. The result is that by the employment of the above device a power company operating a two-phase system is in a position to take on three-phase power loads as easily as two-phase. By soliciting nothing but three-phase business and by changing the existing installations to three-phase as they need replacement or as other occasion makes possible, the entire load can be gradually converted to three-phase, on the completion of which the distribution feeders corresponding to bus *C* can be removed from the entire system, leaving a straight three-phase system.

Transition Can Extend Over Several Years

The period required for such a transition can extend over several years if necessary, as it involves no temporary work and at any step in the conversion the system is left in an efficient operating condition.

In case it should be desired to take a three-phase installation from an existing two-phase bank of transformers, a teaser transformer with an 86.6 per cent tap must be provided and the secondaries T-connected. In case it is desired to hasten the transition to three-phase or in the case of an obstinate installation which cannot be cut over to three-phase, a transformer bank can be provided as shown in Fig. 3 with T-connected primaries and connected directly to the three-phase primaries.

With the arrangement described, since the main transformer needs only a 50 per cent tap, an ordinary transformer can be used as the 50 per cent point is usually brought out on the secondary side and can easily be brought out on the primary if necessary by drilling the case and inserting a bushing. Only the teaser with the 86.6 per cent taps need be provided. Whether this combination is connected directly to the

two-phase system through the 100 per cent taps or to the three-phase primaries as shown in Fig. 3, the secondaries can be interconnected as indicated to give both two-phase and three-phase service from the four secondary wires. When the entire load on a transformer bank has been changed over to three-phase,

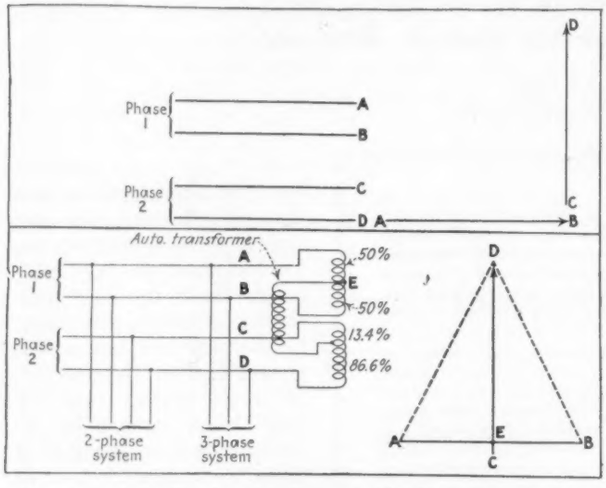


FIG. 1—TWO-PHASE BUS AND VECTOR RELATIONS OF THE PHASES
FIG. 2—METHOD OF INTERCONNECTING TWO-PHASE BUSES WITH AUTO-TRANSFORMER TO SECURE THREE-PHASE SERVICE

feeder *C* in Fig. 3 can be removed and the bank cut over to straight three-phase operation.

Since for the same load the current per conductor in the three-phase system is only 15.6 per cent greater than that in the two-phase, it will seldom be the case that larger conductors will be needed either in the primary or the secondary lines, while the fourth conductor removed from the entire system can be credited to the cost of conversion and will offset to a great extent what small investment may be required for new equipment. After all the power transformer banks have been cut over to straight three-phase operation or their primaries T-connected as shown in Fig. 3, the fourth conductor can be removed to the station on each feeder circuit, and the next step is to eliminate the fourth busbar, *C* in Fig. 2. This can be very easily accomplished by the judicious choice of T-connected transformer capacity through which the station buses are interconnected.

ORDER IN WHICH CONVERSION CAN BE EASILY MADE

Assuming first that the total station capacity is made up of generating units of different capacities, the first set of T-connected bus-tie transformers should have a capacity equal to that of the smallest generating unit. After enough three-phase load has been added to the system or converted from two-phase to load up this set of bus-tie transformers, they should be replaced by a set whose capacity equals that of the next larger generating unit, and the first set connected directly to the terminals of the smallest unit, making a three-phase machine of it.

The switchboard panel for this unit then can be worked over and the machine connected directly to buses *A*, *B* and *D* in Fig. 2. Working over the panel requires very little time or expense, as it is only necessary to remove the fourth cable and reconnect the meter circuits. Care must be taken, however, to connect the synchronizing circuit to phase *AB*, as this will be the only phase common to both the two-phase and three-phase systems. After the second set of bus-tie transformers has become well loaded with the three-phase load, they in turn should be connected to the terminals of the unit of like capacity and replaced with a set corresponding to the next larger unit. In this manner each machine is in turn converted to a three-phase unit and connected directly to buses *A*, *B* and *D*, while at any time during the transition any combination of generating capacity will supply both the two-phase and three-phase components of the load. Assuming now all of the units to be of the same capacity, the first bus-tie installation should have a capacity equivalent to that of a single unit, and the second may consist of two similar banks in parallel. Other combinations of generating units will suggest other arrangements of bus-tie transformers.

AUTO-TRANSFORMERS PERMIT SERVING TWO AND THREE-PHASE SYSTEMS SIMULTANEOUSLY

During the transition new three-phase generating units may be added to the buses, and it may be possible to carry the entire load on the three-phase units as the T-connected bus-tie transformers will function in the opposite direction and supply whatever two-phase load still remains unconverted, due regard being paid to the relative capacities of the bus-tie transformers and the remaining two-phase load.

If the plan is carried out as above described, the last two-phase machine will have been converted to a three-phase unit at the same time that the fourth wire has been completely eliminated from all the feeder circuits, and the fourth bus, *C* in Fig. 2, can then be removed, leaving a straight three-phase system throughout. The transition as above outlined will involve very little expense and no temporary work or new construction.

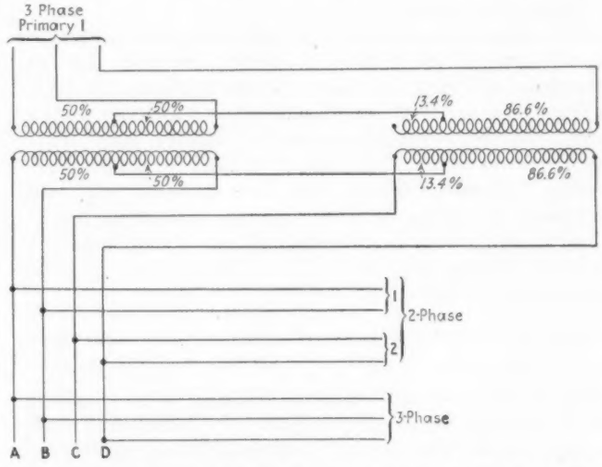


FIG. 3 — METHOD OF SECURING EITHER TWO-PHASE OR THREE-PHASE SERVICE ON CUSTOMER'S INSTALLATION IN A TRANSITION STATE BETWEEN THE TWO CLASSES OF SERVICE

It will also involve no interruptions whatever of any of the circuits, and it has the further advantage of being flexible in that it can either be hurried to completion or made a gradual development covering an extended period of time, the system being able to remain indefinitely in a normal operating condition at any step of the transition.

Hence no company has an excuse to retain an antiquated two-phase system of generation and distribution.

Anticipating the Complaint

Virginia Railway & Power Company Finds that the Investigation of Any Unusual Consumption of Energy Before the Bill Is Rendered Virtually Eliminates Errors in Meter Reading and Pleases Customers

By G. H. SMITH
Commercial Manager Virginia Railway & Power Company, Norfolk, Va.

THE war period and the general readjustment that followed forced upon public utilities, particularly those in the metropolitan centers, many problems in overcoming irregularities developed during those times. Probably in no branch of the industry was this condition more forcibly brought to attention than through meter readings, which it frequently seemed to the customer did not accurately represent consumption. Generally speaking, conditions reached a point where the mutual confidence between the utility's customers and the company was in jeopardy.

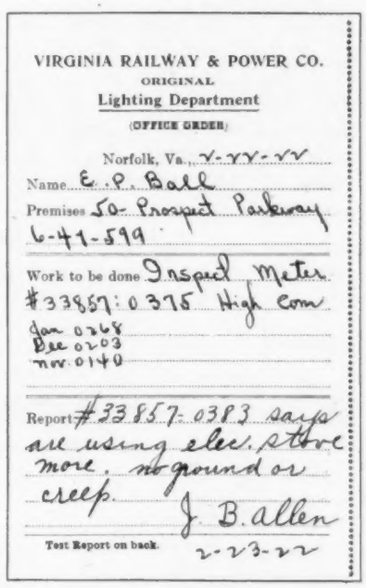
The Norfolk situation did not differ from that in other cities, and it provided a difficult problem to solve. The inauguration of a new system was a formidable undertaking. However, after careful thought, a plan was adopted which we feel prevents in a great measure what is commonly known as a "high bill." At least, it places the company in a position where it can intelligently discuss the matter with the customer, should he or she feel that the bill is unnecessarily high.

My reason for stating the case in this manner is that we, in a measure, "anticipate the complaint." Having had in use numerous forms for the checking, inspecting and testing of meters, both gas and electric, it was deemed advisable not to modify these forms, but to use them in a slightly different manner and in several additional departments. The forms and order blanks which are in daily use are shown here.

The form shown in Fig. 1 is nothing unusual, except that it is the one used to cover request for information from one department to another. Fig. 2 shows the bill with the report attached sent to the consumer after an investigation has been made. After this investigation the amount of the bill can be easily determined by those whose duties include service at the complaint desk, the several steps of routine involving the meter-reading department, the inspection or service department, the bill-making department and the commercial department.

The first step quite naturally takes place in the meter-reading department, whose duties cover the monthly indexing of meters. In fact, the first step is with the meter reader himself, who has instructions that before leaving a consumer's premises he shall make a subtraction to show the amount of service recorded by the meter. On finding that there has been an increase or a decrease in excess of 50 per cent as compared with the preceding month, he again checks the meter index to verify its correctness. At this point nearly all incorrect readings are eliminated. To show that a second examination was made, he places a mark directly after the index, which in turn is noted by the checkers when the books are turned in to the meter-reading office.

The second step is the supervision given the readings in the meter-reading department. The duties of the inspectors here are to analyze the account, studying it from previous records, noting the appliances in service


VIRGINIA RAILWAY & POWER CO.
ORIGINAL
Lighting Department
(OFFICE ORDER)

Norfolk, Va. Y-YY-YY

Name E. P. Ball

Premises 50- Prospect Parkway

6-41-599

Work to be done Inspect Meter

#33857: 0375 High Com

Jan 0268
Dec 0203
Nov 0140

Report #33857-0383 says are using elec. stove more. No ground or creep.

J. B. allen

Test Report on back. 2-23-22

FIG. 1—FORM USED FOR ORDERING INVESTIGATION OF UNUSUAL CONSUMPTION

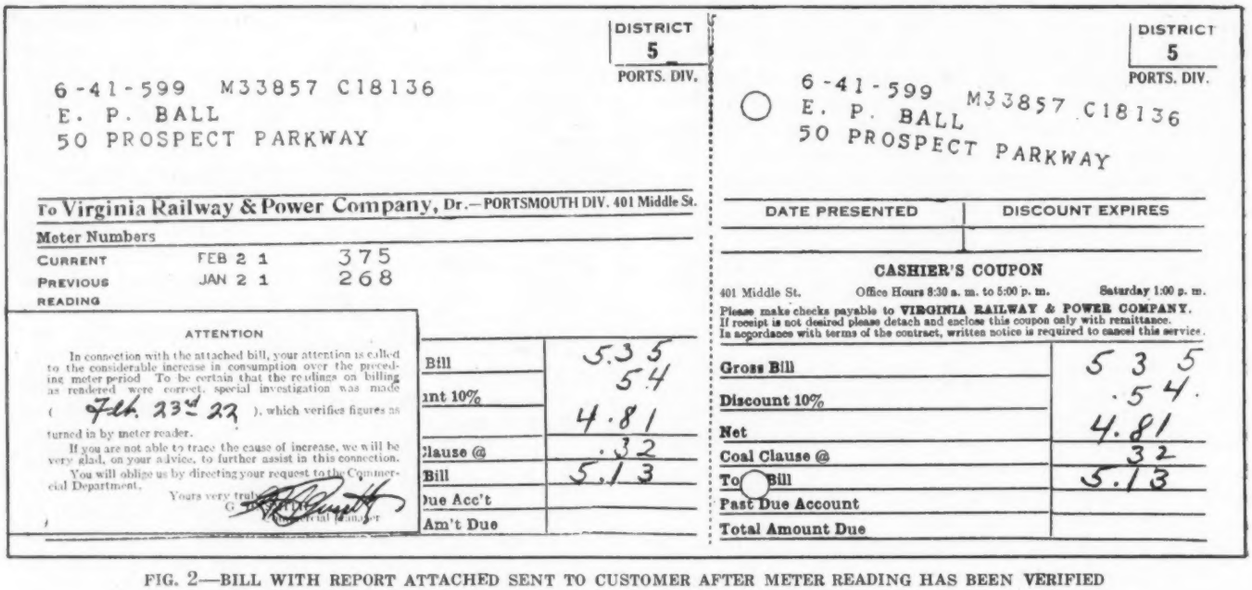
or the nature of the service, and then governing their action accordingly. Should the account, after the meter-reading department's work has been done, appear to be of a nature that would attract the special attention of the consumer, the form shown in Fig. 1 is used. This is prepared in triplicate, one copy being held as a record and two copies forwarded to the inspection department. On this form are written the consumer's name, address, account number (for future identification), meter number and the nature of the information desired, with the omission, however, of any information pertaining to the index as turned in by the meter reader. Orders of this kind are forwarded to the superintendent in charge of the inspectors. The territory of these inspectors is localized in accordance with the work performed during the previous day by the meter readers. Upon completion of the investigation one copy of the order is forwarded to the commercial department and the other returned to the meter-reading department. This practice acts as a check on the work of the inspector himself.

While the inspector is at a consumer's premises his duties are to inform the consumer of the reason for his visit and to ask such questions as will enable him to assist in determining the cause for the increase or decrease. This inspection service again eliminates a great number of meter-reading inaccuracies. The copy of the order delivered to the commercial department is filed so as to make it readily accessible for explanation to the consumer later and for reference in connection with releasing the bill.

So as not to cause delay between the meter-reading department and the billing department, the route books covering the district are forwarded to the billing department. Previous information and marks, however, on the route book indicate that an inspection order is in process of being executed, and the account bearing such marks is set aside. Before releasing it the previous three months' meter readings are listed on the

reverse of the bill stub. When the district has been checked, such bills are forwarded to the commercial department. This necessitates the matching of the miscellaneous orders or reports with the bills released by the billing department, and experience has taught us that invariably there is an inspection report for each bill received. The employee or complaint clerk in the commercial department then checks the data contained on the bill and on the reverse side of bill stub, comparing them with the data contained in the inspector's report. This makes it an easy matter to determine whether the bill is properly prepared.

On completion of inspection in the commercial department, the form shown in the lower left hand corner of Fig. 2 is attached to the bill. This bears the date of the inspector's visit and states that in so far as meter readings are concerned the bill as prepared is correct. It likewise invites the consumer, should he be unable to trace the cause for the increase or the


DISTRICT 5 PORTS. DIV.

6-41-599 M33857 C18136
E. P. BALL
50 PROSPECT PARKWAY

To Virginia Railway & Power Company, Dr.—PORTSMOUTH DIV. 401 Middle St.

Meter Numbers
CURRENT FEB 21 375
PREVIOUS READING JAN 21 268

ATTENTION

In connection with the attached bill, your attention is called to the considerable increase in consumption over the preceding meter period. To be certain that the readings on billing as rendered were correct, special investigation was made (Feb. 23rd 23), which verifies figures as turned in by meter reader.

If you are not able to trace the cause of increase, we will be very glad, on your advice, to further assist in this connection.

You will oblige us by directing your request to the Commercial Department.

Yours very truly,
G. [illegible]
Commercial Manager

Bill	5.35
Discount 10%	.54
	4.81
Coal Clause @	.32
Total Bill	5.13
Past Due Acc't	
Total Am't Due	

DISTRICT 5 PORTS. DIV.

6-41-599 M33857 C18136
E. P. BALL
50 PROSPECT PARKWAY

DATE PRESENTED	DISCOUNT EXPIRES

CASHIER'S COUPON

401 Middle St. Office Hours 8:30 a. m. to 5:00 p. m. Saturday 1:00 p. m.

Please make checks payable to VIRGINIA RAILWAY & POWER COMPANY. If receipt is not desired please detach and enclose this coupon only with remittance. In accordance with terms of the contract, written notice is required to cancel this service.

Gross Bill	5.35
Discount 10%	.54
Net	4.81
Coal Clause @	.32
Total Bill	5.13
Past Due Account	
Total Amount Due	

FIG. 2—BILL WITH REPORT ATTACHED SENT TO CUSTOMER AFTER METER READING HAS BEEN VERIFIED

decrease, to get in touch with the commercial department, which will follow the matter further. In a majority of cases, however, when the consumer visits the commercial department or makes his request by letter, the data in hand (in the inspector's report) are sufficient to convince the consumer that the amount billed is for service rendered.

In case the consumer is not satisfied and believes that the meter is faulty, there is no hesitancy on the part of the company to issue a test order. Employees making the test are trained so as to be able to discuss the conditions with the consumer while they are on his premises. This final inspection nearly always convinces the consumer that the company's effort has been in their mutual interest, and usually the matter ends to the consumer's satisfaction.

In spite of the evidence to the contrary, there are, however, a few consumers who feel that the company's work is on its own behalf alone. In these instances we take advantage of a city ordinance which provides for a test of the meter by the city's superintendent of electrical affairs. This brings into the transaction a neutral party, whose decision determines the company's course.

It has been found that the practice described above has added little or no expense to the operating department; in fact, a close analysis would probably show that it is a "money saver" as well as a "public pleaser."

The several steps in the process reduce the complaints to a point where very few ever reach the city authorities for a report from the city inspection department. The practice followed regarding the installation of properly approved meters is likewise helpful. Service of this kind is maintained by the city, the company paying a testing fee. All meters bear the official stamp of the city before they are installed.

A great many letters have been received commenting on the company's practice. One of these, received from a very prominent consumer and now in the company's files, is as follows:

"In connection with your bill for electric service, the amount was not unexpected—an unusual report from the consuming public—as we had a great deal of sickness during the month and auxiliary heating equipment was installed. I am particularly interested in your practice and can readily understand why a company should inspect for a low consumption; but the practice in this instance is doubly interesting as it differs from what has been my experience elsewhere in the past."

Another letter from a customer reads:

"The inclosed large light bill with notation attached deserves favorable comment. This month, and once last spring, before and after our furnace was in use, we used in our home an electric heater, and naturally our light bill was larger. In both instances your meter reading was checked unsolicited; also an inspector was sent out to find leakages, if any. In each case the inspector found the reason already known to myself.

"The average consumer would expect a public utility company to chase up a decrease in bills, but the writer wishes to acknowledge the equal readiness shown to check up an increased bill."

The theory of this practice is that the best kind of defense is a strong offense. When the consumption recorded appears to be amiss an investigation is made by the company and the facts are determined before the bill is rendered. This materially affects the customer's attitude and position, for if the explanation is not satisfactory, it is squarely up to him to supply further information.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Dielectric Loss and Breakdown

To the Editors of the Electrical World:

When alternating voltage is applied to a dielectric the resulting current leads the voltage in phase by less than a quarter of a period. The current may thus be considered as consisting of two components, one in phase and the other in quadrature with the voltage. But the trouble is that, with the composite insulating substances used in practice, neither of these components may be predetermined or bears any known relation to the constants of the substance as determined by continuous-current measurements. The charging component is not determined by the dielectric constant, nor the watt component by either the insulation resistance or any known law of dielectric hysteresis. These several properties are, in fact, so intimately and obscurely related to each other that up to this time no satisfactory theory has been found to account for the behavior of insulators under alternating stress.

One fundamental property of most insulators, which may be readily observed, is a promising starting point for research paths into this interesting field. When continuous voltage is applied, the charging current does not die out rapidly as required in a circuit with fixed constants, but decreases slowly, sometimes over a period of minutes, finally reaching a constant value determined by the insulation resistance. There is apparently a progressive penetration or soaking in of voltage, causing a slow charging current. Evershed has studied the curves of this type for various substances and offers an ingenious explanation which involves the conductivity and motion of water in capillary fibers in the insulation. No effort has been made, however, to extend this conception to the case of alternating voltage, in which, obviously, the short period of cyclic reversal applies to only the briefest initial portion of the continuous-voltage charging curve.

Maxwell suggested that dielectric hysteresis and the losses in insulation are due to variations in the values of dielectric constant throughout the mass of the insulator. Others have attempted electromechanical explanations, involving oscillating systems of different degrees of damping within the molecules of the dielectric. No one of these, however, accounts for the observed facts except in an approximate way.

At the moment there is a tendency to minimize the importance of dielectric hysteresis as a factor in insulation losses and to ascribe the phenomena of loss and breakdown to simple conductivity. In its simplest form this idea is that the conductivity varies throughout the mass of the insulator and that the current density is, therefore, greater in certain regions. Under voltage local heating results with further increase of conductivity. If the heat is dissipated fast enough, the temperature does not rise and the current is limited. With unchecked temperature rise the effect is cumulative, resulting in a "hot spot," further conductivity and breakdown.

This view is most attractive in its simplicity, and it accounts for some of the conspicuous facts, as indicated by the paper by Hayden and Steinmetz in the issue of Oct. 21, page 865. But the matter is by no means so simple as this. It does not require much study of the properties of composite insulators to realize that insulation resistance, power factor, charging current and loss vary from sample to sample in the most erratic way. High dielectric loss and high resistance may go hand in hand, and so far, comparison of observations of the quantities mentioned, through a wide variety of materials, has not yielded any suggestion of a rational relationship. However, two definite facts are slowly emerging from the few disconnected efforts being made in this field. One is that an insulator approaches breakdown, not suddenly, but relatively gradually, through a period in which the dielectric losses, either locally or generally, are greatly increased with corresponding elevation of temperature. The other is the great influence of moisture in its relation to temperature in increasing loss leading to breakdown.

While in the final stages temperature undoubtedly plays an important rôle, the evidence does not yet indicate that we may leave dielectric hysteresis out of account. It appears that in pure insulators, free from fibrous ingredients, the dielectric hysteresis loss, long supported by theory, is still the important factor. In composite insulators materials are introduced which, in the presence of water and temperature, form paths through the structure of such great conductivity as to overshadow the phenomena pertaining to pure dielectrics.

JOHN B. WHITEHEAD,
Professor of Electrical Engineering.
Johns Hopkins University,
Baltimore, Md.

Failure of Insulation

To the Editors of the Electrical World:

I consider the article by Messrs. Hayden and Steinmetz on "Insulation Failure," printed in the *Electrical World*, Oct. 21, page 865, a very valuable contribution to the subject. The idea that insulation failure may be directly attributable to high temperature will open up new methods of attack in research work. There are two questions that have occurred to me that perhaps the authors can answer:

1. It is pointed out in the article that "the disruptive strength of built-up material does not increase proportionally to the number of layers or thickness, but at a materially less rate." In accordance with the thermal theory, does this hold if the applied voltage is sufficiently high to cause the insulation to fail before any appreciable amount of heat can be dissipated by conduction, convection or radiation? That is, the time would be so short that practically all of the generated heat would be stored in the parts of the insulation that are highly stressed. It would seem, then, that the disruptive strength would be in proportion to the thickness.

2. If the thermal principle holds, why not place some insulating material in a thermos bottle or similar container, so as to prevent the escape of heat, then apply comparatively low voltage, just enough to heat the insulation continuously? Such voltage would be very much below that which would ordinarily be considered as needed for breakdown. It would be very interesting to note whether or not the insulation would then fail.

While the Nernst lamp glower fails to be an insulator when subjected to high temperature, it does not necessarily follow that all of the various kinds of insulations are similarly affected.

C. J. FECHHEIMER,
Research Engineer.
Power Engineering Department,
Westinghouse Electric & Manufacturing Company.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Ornamental Street Lighting in Lima, Ohio

GRADUATION of candle-power, mounting height and spacing in accordance with the requirements of the individual streets is a feature of the new ornamental street-lighting installation at Lima, Ohio. The system is one of the most complete and up-to-date in the country and cost approximately $250,000. It comprises 1,245 units, extending over 16.2 miles, and covers the entire downtown business section of the city and four principal residence streets. It includes an underground system for ornamental posts operated from a turbo-generator equipment in the municipal pumping station through constant-current 6.6-amp. regulating transformers. Petitions have been circulated by property owners for several extensions.

RESIDENTIAL STREETS ADEQUATELY LIGHTED BY STANDARDS EVERY 100 FT. EQUIPPED WITH 250-CP. LAMPS

In the public square the posts are 15 ft. high, with 1,000-cp. lamps with special refractors, throwing the light toward the center of the square. On the main business streets they are 13 ft. 3 in. high, with 400-cp. lamps. On the minor business streets and in the residence sections the height of the posts is 12 ft. 3 in., and they are equipped with 250-cp. lamps. In the downtown business section the standards are spaced 50 ft. apart. In the rest of the system the spacing is 100 ft. Throughout the system the plan of opposite spacing was adhered to. Much time and thought were devoted to the height, spacing anl location of standards and are the result of observations in all the principal cities of the Middle West, supplemented by data collected by considerable correspondence with other cities of the United States. Despite the usual pleas of property owners for changes of locations for individual posts, the Director of Public Service insisted upon the posts going in as laid out. As all now acknowledge, this has resulted in a uniformity of illumination which greatly increases the efficiency and beauty of the system.

In the installation steel-taped lead-covered cable was used for the underground system, while single-conductor rubber-covered and braided cable was used for the post wiring. Westinghouse-Cutter "Continental" posts were selected, equipped with "sol-lux" tops and "monax" diffusing glassware. The lamps for 400 cp. and upward are operated through auto-transformers in the capitals of the posts, and the 250-cp. lamps are equipped with "Regent" repeating film sockets.

The system, which is divided into ten circuits, is operated from a turbo-generator, supplemented in reserve by an engine-driven 150-kw. generator in the city pumping station, through ten 34-kva. constant-current regulating transformers. Two circuits, extending throughout the system, including street and alley intersections and the intervals between them, are on all night. The remaining light circuits are turned off at midnight. During December, 1921, the consumption was 57,000 kw.-hr., while in June, 1922, it was 33,200 kw.-hr.

A disconnecting pothead is installed in the base of each post, which in the event of a post being accidentally broken automatically disconnects the broken post, short-circuits the line and leaves the rest of the lamps burning.

The alley intersections are lighted by special brackets attached to the corners of the buildings and operated from the underground system through safety coils. By this new installation the necessity for unsightly overhead equipment has been eliminated, thus adding greatly to the appearance of the streets, hitherto cluttered up with overhead pole-line equipment.

ELMER MCCLAIN,
Formerly Director of Public Service.
Lima, Ohio.

Maintenance Periods for Oil Circuit Breakers

THE desirable interim between successive overhaulings of oil circuit breaker equipment was discussed informally at a recent meeting of the New England System Operators' Club. Opinions differed considerably as to the necessities of this work.

One large company located outside New England which was represented at the meeting tests oil switches every six to eight weeks, the tanks being removed, contacts inspected and insulators cleaned at the time. Regardless of the type of switch used, the cleaning crew includes this inspection in its routine visits to plants and substations. The

troubles found are mainly of a minor nature, such as dirty insulators, occasional sparking and now and then a loose contact. Bus insulators are cleaned at the same time. In view of the hazards of this work and accidents which have at times accompanied it, the company is considering extending the interval between inspections.

Another large system overhauls its oil switches annually. Those which are subjected to severe shock at any time are overhauled immediately after the shock. Nothing of enough importance to warrant as many as six inspections a year has ever been found wrong with switches that have not performed other than their ordinary functions. The switches are cleaned as often as necessary to keep them in proper appearance and condition, whether weekly or monthly depending on the amount of construction or other work being done in the plants which would cause them to be coated with dirt and create a hazard.

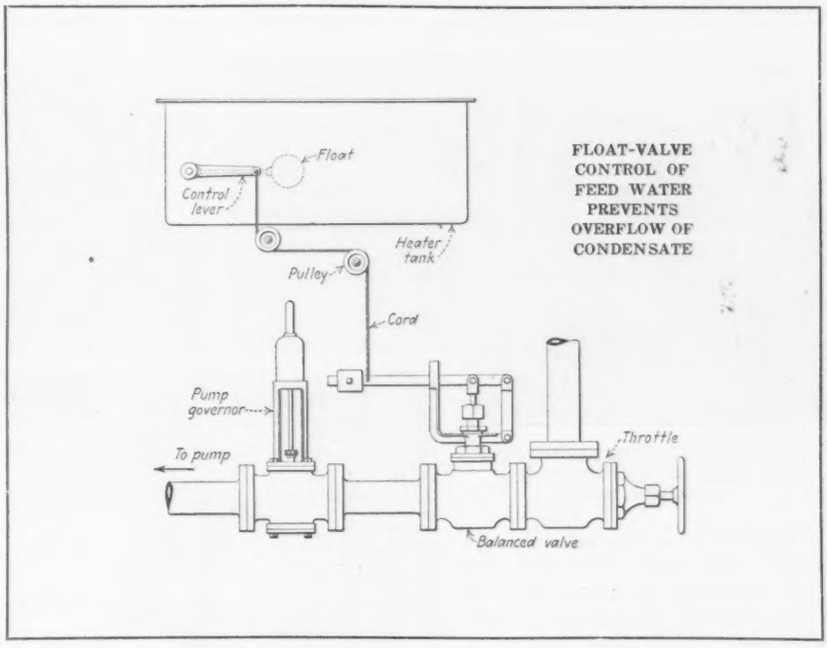
ACCESSIBILITY IMPORTANT IN OIL-SWITCH DESIGN

Operating engineers at the meeting generally agreed as to the importance of prompt inspection and overhauling of oil circuit breakers after severe trouble is experienced. The importance of accessibility in switch design, in order to give the operator requisite information as to the alignment of fixed and moving contacts, condition of contacts and other features, was emphasized. Some of the older designs of switches which are lacking greatly in convenience of interior access have operated several years without taking down, one installation of 66,000-volt oil circuit breakers being cited as operating successfully for five years after overhauling, but it was not considered good practice to allow such protracted periods to elapse between overhauls. Another operating company favors inspection of feeder switches which are opened only occasionally, about once in six months, if there are no severe short circuits. Switches on generators which are opened daily or every few days are examined every three months to insure proper condition of contacts. The frequency of inspection depends somewhat on the service rendered. The discussion brought out the importance of frequent cleaning wherever switches are in dusty locations.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Irregular Action of Feed-Water Pumps Overcome by Simple Device

TO PREVENT the loss of turbine condensate through the overflow of feed-water heater tanks caused by the hot-well pumps supplying water to the tanks at an irregular rate, the Galveston-Houston (Tex.) Electric Railway Company used the float-valve control to regulate the speed of the boiler-feed pumps in its Webster station. This station is equipped with hot-well pumps of the volute type, which are able to handle considerably more water than necessary. Consequently they will discharge a large amount of water, thoroughly draining the hot wells and all connecting water piping. This creates a partial vacuum in the feed-water heater, and as the vacuum tends to lower the head which the hot-well pumps are discharging against, additional water is pumped up by the other hot-well pump, which quite frequently causes the heater to overflow.



FLOAT-VALVE CONTROL OF FEED WATER PREVENTS OVERFLOW OF CONDENSATE

The float and external control lever used are on the same side of a fulcrum pin, and a ¼-in. flexible steel cable passing through several suitably arranged metal pulleys forms the connecting link between the control lever and a balanced valve at the feed-pump throttle. A positive stop is also placed under the lever of the balanced valve to prevent the feed pump from shutting down entirely and losing its priming when the lever is in its lowest position. By having this stop drilled and tapped inside and screwed down on a small stud bolt so that the stop can be raised or lowered, considerable flexibility of operation can be obtained. A pump governor is also placed on the pump side of the balanced valve to prevent the pump from building up a pressure which would cause the relief valve to operate, and also to protect the pump and connecting piping should it be necessary to close all the feed valves.

When using this method it is desirable to regulate the feed-water valves by hand. The valves are adjusted according to the amount of water each boiler is evaporating, and the peculiarities of each boiler must be considered. Very little change in the setting of the valves will be required, regardless of changes in load, if the boilers are kept pulling together. This is comparatively easy in an oil-burning plant equipped with steam-flow meters. At this station it has been possible to run from one shift to another without touching anything but the make-up water valve, although a variable interurban and street-railway load is carried. Of course, a change is imperative at night when the light load makes it necessary to cut out boilers.

The fireman regulates the make-up water valve by the water level in the boilers when the control lever is at its central position. As the amount of makeup required is fairly constant, this setting, if anywhere near correct, will run for several hours with only a slight increase or decrease in

the boiler-feed water level. With this method the boilers, turbines, condensers, etc., should be considered as forming a closed loop so that the rate of flow is entirely automatic.

It might seem that complications would arise due to sudden changes in the load, but such is not the case. If a heavy peak occurs, the boiler-water level is lowered slightly and will continue to remain in that position until the peak is over. This is due to the fact that more water is making the trip around the loop, which is an added safeguard against the boilers forcing water over to the turbines while operating under heavy ratings. When the load returns to normal the boiler-water level will pick up to one-half glass, or whatever it is set at. It would seem from this that the most desirable characteristics of a high-grade feed-water regulator are here combined in a very simple way.

This method is not recommended to displace feed-water regulators, but is suggested for trial in stations having heater troubles similar to those already mentioned. Under such conditions it will improve the feed-water temperature and will prevent the loss of condensate. It is entirely automatic. It is cheap and very easy to install and is applicable to any medium-sized power station having surface condensers and open feed-water heaters.

This scheme was suggested to the writer by C. W. Brown of the Stone & Webster engineering department as a means to overcome the trouble stated and is really an adaptation of the well-known marine control of feed water.

R. E. GLEASON,
Assistant Chief Engineer.
Galveston-Houston Electric Railway,
Houston, Tex.

Testing A.-C. Watt-Hour Meters in Bulk

Labor-Saving Equipment Used in Manufacturer's Laboratory Suggests Conveniences Applicable to Utility Meter Department —Routine Tests Standardized

THE large number of meters passing annually through the test of the factory with which the writer is connected has put such a premium upon labor-saving methods that some of the methods used may contain suggestions for the central-station man responsible for testing many hundreds or perhaps thousands of meters yearly.

The first requisite of a commercial testing department is adequate means for maintaining the standards of comparison. In our laboratory standard cells used with the potentiometer are employed as a primary, the cells being sent frequently to the Bureau of Standards at Washington for verification or correction. Timing is accomplished by an electric clock operating from a vibrating reed, making it possible to determine time down to one-fortieth of a second. The secondary standards are watt-hour meters kept in perfect calibration by comparison with our primary standards. The secondary standards are mounted on the test racks and compared directly with the product under examination.

The order of testing pursued is as follows:

1. Meters are carried from the assembly department to the laboratory on hand trucks, with covers in place to shield from dust and protect meters against accidental injury. A 2,000-volt breakdown test is applied between windings and base.

2. Power-factor adjustment or "quarter-phasing" is performed, to insure accuracy on loads varying from zero to 100 per cent power factor.

3. Meters are first inspected for defects, then adjusted for full load and light load accuracy.

4. Time run, to develop and magnify any residual errors.

5. Second check of power factor and speed under varying load.

6. Final breakdown test between meter base and windings, to check condition of meters after passing through testing department.

The outfit used in the 2,000-volt ground or breakdown test is shown in Fig. 2. To insure safety, the tester is required to hold the main-line switch closed while making the test. This is done by a cord held in one hand, the switch being immediately opened by a spring upon release of the cord. This occupies one hand, and the other hand is used in manipulating the test plug.

The power-factor adjustment, shown in Fig. 1, is accomplished by using a zero method, the meter being

FIG. 1—POWER-FACTOR ADJUSTMENT BY ZERO METHOD REQUIRES MINIMUM TIME

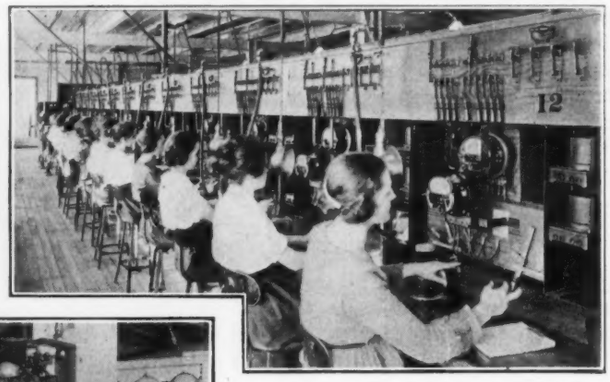


FIG. 3 — TWO SWITCHES SUFFICE FOR TWO POWER-FACTOR AND TWO LOAD TESTS

FIG. 2—AUTOMATIC SWITCH RELEASE AND ONE-HAND MANIPULATION OF TEST PLUG SAFEGUARD OPERATOR

placed on a test rack below a master meter. The operator connects the current coils of the two meters in series and the potential coils in multiple. The circuits of the testing rack may be adjusted to yield an exact quarter-phase relation between the current and the voltage. With rated load passing through the meters and rated voltage impressed on the potential coils, the operator adjusts a rheostat until the master meter gives a zero indication. He then adjusts the resistance in the compensating windings of the meter under test until a condition of no rotation is obtained. When the proper adjustment is attained, the resistance is soldered to give a permanent connection. Fig. 4 shows the circuit diagram for the quarter-phasing rack. This provides for testing meters at different commercial voltages through appropriate switching and transformer connections as detailed. The load is taken from a straight potential transformer and the voltage from a multi-tap transformer giving 110, 220 and 440 volts. The power-factor adjustment is by a rheostat connected across an auto-transformer, the handwheel being shown at the left of the testing rack in Fig. 1.

After the quarter-phasing operation is complete, the meters are set

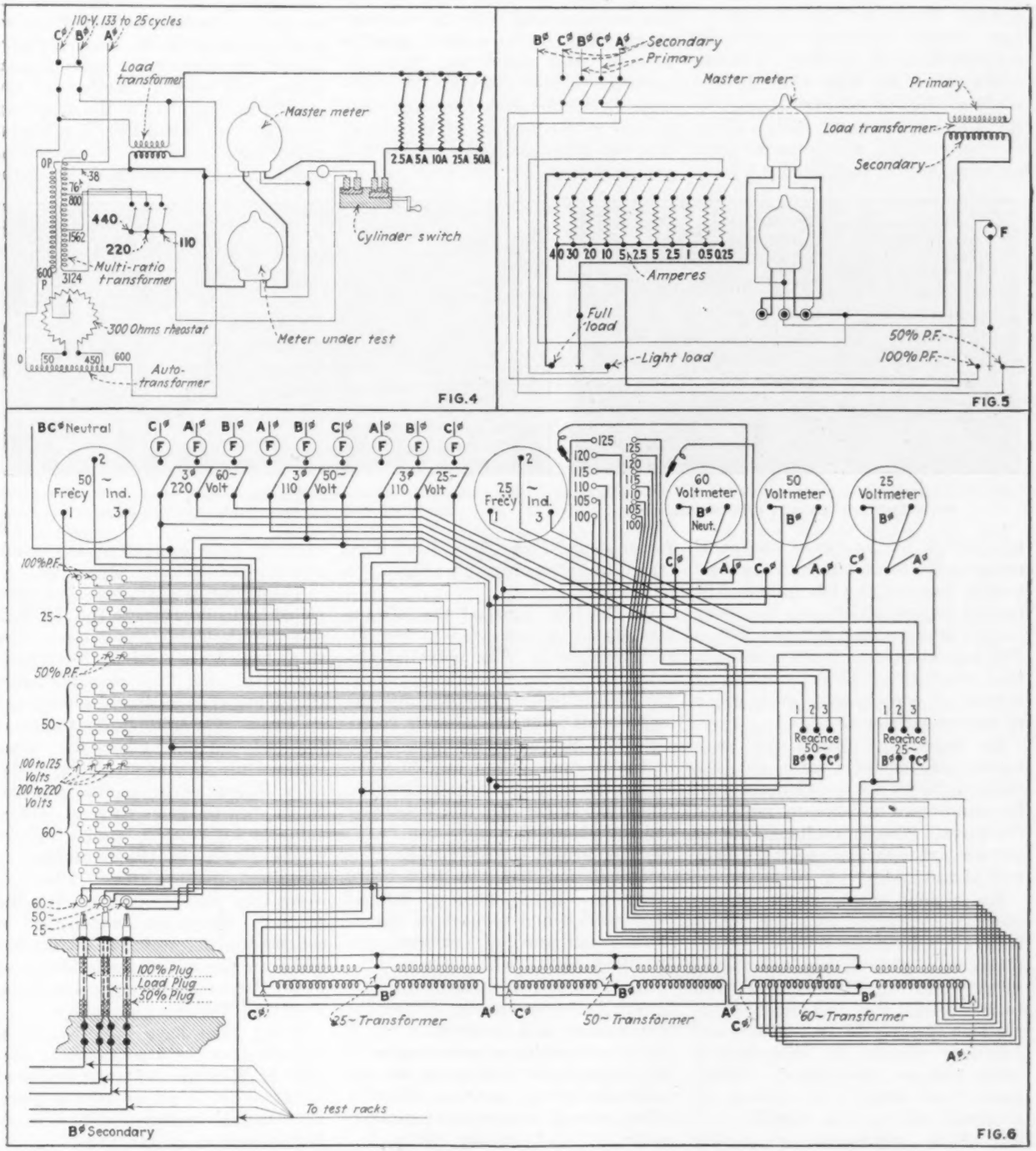


FIG. 4 — QUARTER-PHASING RACK PROVIDES DIFFERENT VOLTAGES FOR TESTING METERS. FIG. 5 — WIRING OF SPEED TEST PANEL FOR VARIED LOAD AND POWER FACTOR. FIG. 6—WIRING DIAGRAM OF PLUG BOARD SHOWN IN FIG. 7

up in the racks shown in Fig. 3. Here a thoroughgoing visual inspection is made and the speed at light load and full load is compared accurately with a master meter installed just above the meter under test. Under both load conditions the test is made at 50 per cent and 100 per cent power factor. The wiring diagram of these test panel units is shown in Fig. 5. The load values are obtained by a series of knife switches cutting in and out resistance as indicated. These are not adjusted except when changing from one capacity meter to another. The two power-factor and light and full-load readings, four in all, are obtained by the simple process of manipulating two single-pole, double-throw knife switches, one for each hand. A four-pole switch at the top of the panel connects the testing rack to the main testing panel of the laboratory. The central station which uses the above testing arrangement will find it flexible and adapted to quick manipulation whether a large number of meters of one capacity or a group of varied ratings be tested.

In inspecting meters for loose screws, proper train ratio, etc., the operator blows out accumulated dust by compressed air before replacing the cover. Pipe connections for this service are provided between each pair of test racks.

On account of the range of frequencies, voltages, etc., for which meters are built, an unusually complete main distributing test board (Fig. 6 and Fig. 7) was built. The former gives the diagram of connections for this board. This board supplies energy to the testing racks where the speed adjustments are made. It consists of a group of vertical panels, each of which represents a testing rack, and appropriate receptacles in groups according to frequency. The insertion of plugs into the receptacles gives the desired energy characteristics at the test racks connected with the plugs. Beginning at the top of the board, the frequencies are 25, 50 and 60 cycles. Referring to one of the vertical panels, the two left-hand rows give the potential connections at 50 per cent power factor. The horizontal rows give different voltage steps. The testing rack has four leads from the main panel which are plugged into the board by one double-contact and two single-contact plugs. The double-contact plug is used for load connection, three receptacles being provided for this plug, or one for each frequency, and located at the bottom of the panel. The two other plugs are for the 100 per cent and 50 per cent power-factor connections. The set-up illustrated in the photograph (Fig. 7) is as follows:

On the first panel at the left the load circuit is connected to the 60-cycle receptacle. The potential circuits are in the 60-cycle group on 220 volts. In the second panel the load circuit is on the 25-cycle receptacle and the potential circuits are in the 25-cycle group on 100 volts. In the third panel the load circuit is connected to the 50-cycle receptacle and the potential circuits are in the 50-cycle group on 125 volts. For central-station use the test board shown in Fig. 6 and Fig. 8 could be simplified and reduced in size as local conditions of voltage and frequency permitted.

A group of meters undergoing a twenty-four-hour running test on the time-running rack is shown in Fig. 8. The laboratory has a present capacity for testing 2,000 alternating-current watt-hour meters per day, allowing a time run of twenty-four hours per meter.

J. HENRY HODDE,
Superintendent Testing Laboratories.
Sangamo Electric Company,
Springfield, Ill.

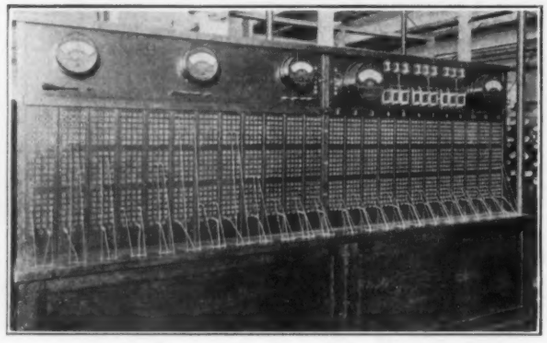


FIG. 7—SYMMETRICAL PLUG BOARD SERVES TEST PANELS WITH REQUIRED ENERGY CHARACTERISTICS

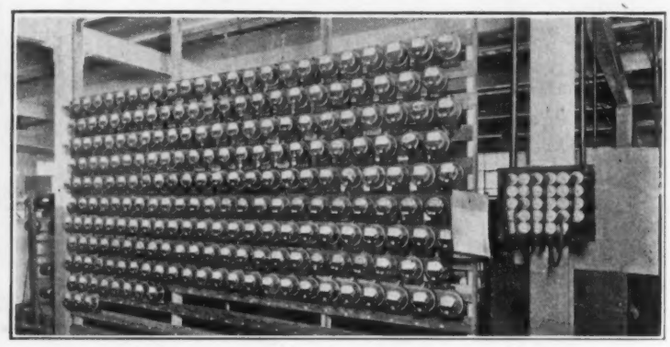


FIG. 8—GROUP OF METERS UNDERGOING A TWENTY-FOUR-HOUR RUNNING TEST ON THE TIME-RUNNING RACK

Steps Taken to Standardize Rating of Arc-Welding Apparatus

AT PRESENT a prospective purchaser of welding equipment is bewildered by the confusing claims concerning special merits of different machines on the market, and unless he has had previous experience in welding he has no basis for judging the relative advantages of the several types. Recognizing the need of a standard method of rating such apparatus, H. M. Hobart, chairman of the electric arc-welding committee and also a member of the standards committee of the American Institute of Electrical Engineers, appointed a small sub-committee under the chiarmanship of W. Spragen to draw up preliminary standards for arc-welding apparatus.

The tentative draft has been completed and submitted to the A.I.E.E. and the standards committee. The rules have been possible through an agreement by the manufacturers that continuous loading for one hour by means of a suitable resistance at full-load current gives the same temperature rise as an all-day operation in service by manual manipulation with the same current. Other valuable information which will be of assistance to the purchaser is contained in these rules. The sub-committee will co-operate with the A.I.E.E. standards committee in completing this work and in fact has had from the outset the guidance of F. M. Farmer, chief engineer of the Electrical Testing Laboratories.

These rules have been issued in bulletin form by the American Bureau of Welding and are considered tentative for a period of one year, after which time they will be modified or adopted as standards.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Selling $2,000,000 of Stock in One Day

How Employees of the Baltimore Company Were Organized to Take Subscriptions and Collect Payments for 20,000 Shares of Preferred Stock in Record Time

WHAT is probably one of the most remarkable customer-ownership campaigns yet recorded in the central-station industry was conducted last summer by the Consolidated Gas, Electric Light & Power Company of Baltimore. In this campaign it sold $2,000,000 par value of its 7 per cent cumulative preferred stock to customers in one day's time. The sale is of particular interest because of the fact that the stock was sold entirely by the personal efforts of employees in lots of not more than five shares to any one customer.

How the company's personnel was organized and co-ordinated through the various departments so as to handle without a hitch such a volume of stock subscriptions in so short a time is told by W. T. Biedler, manager investment department of the Baltimore company. The methods adopted should be extremely valuable to other central-station companies in planning and carrying out similar programs. Mr. Biedler describes the sale as follows:

In 1915 the company first offered to its customers, on the partial-payment plan only, common stock at the market price, and it had by May, 1922, 5,711 common stockholders and 2,970 preferred stockholders. The number of local shareholders at this time was 4,621, 3,612 owning common stock, and 1,009 owning preferred stock. On June 22 this year the company offered $2,000,000 of 7 per cent cumulative preferred stock, to be sold through its employees to its customers at par, or $100 per share, cash or on the partial-payment plan.

The chief item of work in the issuing of the stock lay in obtaining signed subscriptions from a large number of subscribers and in collecting the remittances accompanying the subscriptions. To avoid the embarrassment entailed by a large oversubscription, the demand from the employees and their friends for the stock was tested by a preliminary survey, in which employees who volunteered to obtain signed subscriptions made requests for shares to be allotted them. It was found that upward of 43,000 shares were requested by more than 800 employees. These employees were then constituted employee-agents for the purpose of this subscription, and to each was allotted a definite number of shares for which to obtain subscriptions. It was not deemed necessary prior to or during this campaign to use newspaper "ads" or any other form of publicity other than an information sheet on the preferred stock and some pertinent facts about the company which were given to the employees. As the wide scope of the subscription necessarily required the efforts of a large number of employee-agents, plans were carefully made in detail to insure smooth operation.

Organization of Employees

The plan employed was the organization of the company as a sales body along the regular lines of organization, with department heads supervising the work of team captains. All employees were grouped into teams according to regular departmental lines, and reporting and distributing information was done through the regular routine of the company. The plan was introduced to the employees at a dinner given by the management to department heads about ten days prior to the date of subscription. At this dinner the organization of the employees into eleven sales divisions was explained. The manager of the investment department served as chairman of the general sales committee, consisting of the general heads of each sales division, and was responsible for the operation of the plan. Employees received subscription blanks, information sheets on the preferred-stock issue and sets of instructions.

It may be noted here that the team captains turned in signed subscriptions and remittances direct to representatives of the investment department stationed at the various buildings of the company. This freed department heads of all detail work and allowed them to devote their time to the supervision of the employee-agents. The method of organization and paper work provided was found to operate smoothly. More than $1,000,000 in cash was received, and signed subscriptions for the entire issue of 20,000 shares were turned in on June 22 and 23.

It was found necessary to limit the maximum number of shares that any one customer might subscribe for to five, in order to accomplish the wide distribution desired with the limited number of shares available.

The stock was offered at $100 per share flat, both for cash and on the partial-payment plan, dividends and interest to accrue from July 1, 1922. The stock offered is a cumulative preferred stock, part of a total preferred issue of $7,000,000, back of which there is $14,610,200 (par value) common stock outstanding.

The terms of the installment payment subscription were $10 per share down and $8 per share per month. Interest at the rate of 7 per cent per annum is allowed on payments. Subscribers have the privilege of paying up in full at any time, making advance payments at any time, and, under certain conditions, of canceling their subscriptions. The company issues a fully-paid stock certificate for a number of shares equivalent to the amount actually paid in, with the proviso that at the date of cancellation of the subscription as to all or a part of the shares covered by it a subscriber will be charged for shares not to be taken up with the difference between the subscription price and the last recorded sale on the Balti-

more Stock Exchange prior to the date of cancellation. Any remaining balance after this adjustment will be refunded in cash, or the purchaser may pay such additional sum as will entitle him to a full share. In the event of the death of a subscriber his properly constituted representative may continue the monthly payments or may elect to exercise the refund option.

Employees were paid a commission of $2.50 for the first share and $1 per share for each additional share subscribed for by the same person, or, in other words, the commissions were $1.50 per subscriber and $1 per share.

The one advertisement run in the daily papers of Baltimore announced the closing of the subscription and was inserted on June 23, the day after the sale was completed.

The campaign resulted in about 5,400 subscribers taking the entire issue of 20,000 shares in one day. Of these 2,338 were cash subscribers and 3,049 installment subscribers. Thus the company more than doubled its number of stockholders in Baltimore in one day as a result of the wide distribution of this issue through a large number of employee-agents. The statistics of the results are given in table herewith.

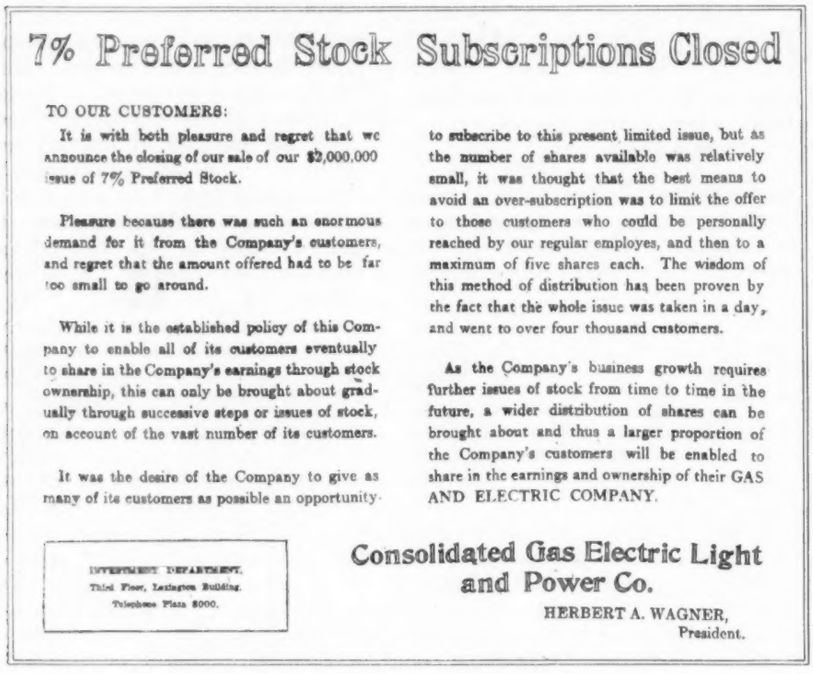
A number of the subscriptions taken on the installment-payment plan have since been converted into cash subscriptions and the stock certificates issued. Approximately 2,200 of the partial-payment subscribers remain on the books of the company. This represents about 40 per cent of the total number of subscribers.

Commissions aggregating $26,631 were paid to 897 employees, the average commission earned being $29.79 per employee and the largest $161. The average selling cost in commissions was $1.33 per share. Including total expense of printing, clerical help, etc., it is estimated that the approximate cost will average around $1.72 per share.

During the week following the campaign an average of over 225 persons per day visited the offices of the investment department in the company's main office building. Most of these wished information and desired to enter subscriptions for stock. Unfortunately few shares were available. One customer insisted that he would not buy anything but "brand-new stock" and "did not want any second-hand stock offered him." Another customer, who had been a street-car conductor for twenty-two years in Baltimore, remarked that he wished to invest in the preferred stock of the company as he had held some of the common stock for a number of years. His route passed the company's twenty-one story office building and he had said to himself every morning as he passed it on his first run, "Well, she's still there, so my money is safe."

The two problems involved in the subscription were, first, to prevent an oversubscription and, second, to insure a wide distribution of shares. These were solved by individual allotments based on a preliminary survey of reports of prospective customers turned in by the employees who volunteered to participate in the sale, and by limiting subscriptions to a maximum of five shares to any one customer.

The result of this short-lived campaign has served to indicate to the management of the Baltimore company the great possibilities of financing through the encouragement of customer ownership. In this campaign less than 5 per cent of the company's customers were approached or had any intimation whatever of the company's intention to sell stock, for the sale was not advertised. The two-million-dollar issue would have been subscribed many times over had subscriptions not been limited to five shares and sales confined to one day.



7% Preferred Stock Subscriptions Closed

TO OUR CUSTOMERS:

It is with both pleasure and regret that we announce the closing of our sale of our $2,000,000 issue of 7% Preferred Stock.

Pleasure because there was such an enormous demand for it from the Company's customers, and regret that the amount offered had to be far too small to go around.

While it is the established policy of this Company to enable all of its customers eventually to share in the Company's earnings through stock ownership, this can only be brought about gradually through successive steps or issues of stock, on account of the vast number of its customers.

It was the desire of the Company to give as many of its customers as possible an opportunity to subscribe to this present limited issue, but as the number of shares available was relatively small, it was thought that the best means to avoid an over-subscription was to limit the offer to those customers who could be personally reached by our regular employes, and then to a maximum of five shares each. The wisdom of this method of distribution has been proven by the fact that the whole issue was taken in a day, and went to over four thousand customers.

As the Company's business growth requires further issues of stock from time to time in the future, a wider distribution of shares can be brought about and thus a larger proportion of the Company's customers will be enabled to share in the earnings and ownership of their GAS AND ELECTRIC COMPANY.

INVESTMENT DEPARTMENT,
Third Floor, Lexington Building.
Telephone Plaza 8000.

Consolidated Gas Electric Light and Power Co.

HERBERT A. WAGNER,
President.

ADVERTISEMENT ANNOUNCING CLOSE OF SUBSCRIPTION

Share Lots	Number of Shares: Employees	Customers	Total	Number of Subscribers: Employees	Customers	Total
1 to 5	1,149	17,174	18,323	528	4,748	5,276
6 to 10	506	20	526	56	2	58
11 to 24	376	.....	376	22	.....	22
25	750	25	775	30	1	31
Total	2,781	17,219	20,000	636	4,751	5,387

Director Puts High Values on Public Relations

FRIENDLY relations between the public and the utility companies aid regulatory commissions in supervising service and adjusting rates of utilities, Carl Wilde, director of service of the Public Service Commission of Indiana, told members of the Indiana Sanitary and Water Supply Association at their recent convention.

"No service," said Mr. Wilde, "however adequate from a mechanical or technical standpoint, can be acceptable and satisfactory to the public service unless the relations between the public and the utility are such that there is courtesy and forbearance on one hand and confidence and forbearance on the other.

"Most utilities are corporations and most of them have a monopoly in their territory. The public, because of an indiscriminate damning of corporations and monopolies generally by a certain type of public

speaker and a particular species of periodical, have come to look askance upon any organization to which those two terms can be applied. It is the utilities' duty to remove this false impression, to show by practical demonstration that properly regulated monopoly is the ideal situation in the utility field and that a corporation can be as courteous and as conciliatory as an individual.

"Friendly relations between the public and the utilities are for those reasons as greatly to be desired as the giving of superlative service, and if the public service commission in the administration of its duties can aid in the slightest toward bringing about such proper public relations, its work in that respect will do more toward solving present-day utility problems than any other work to which it can set its hands."

An Outdoor Demonstration of Electric Heaters

FOLLOWING its policy of advertising and promoting the use of electrical appliances wherever possible, the New York Edison Company is this fall demonstrating electric heaters in an unusual manner. The Simplex Electric Heating Company has made a duplicate of its regular "Sunbowl" heater, 4½ ft. in diameter with a demand of 10.5 kw. The heater is mounted on one of the Edison company's 5-ton trucks, and energy for the heater is supplied

ELECTRIC HEATER WITH 10.5 KW. DEMAND SHOWN ON CITY STREETS

from an "Exide Ironclad" battery loaned by the Electric Storage Battery Company.

The truck with the heater is run about the city streets from 8 a.m. until 9:30 p.m. From time to time it is parked at desirable locations and large crowds collect to examine the unusual source of heat. The radiator will throw a beam of heat for 25 to 40 ft., and it is interesting to watch people on the sidewalk turn around when they feel the blast of heat strike them. In many instances humorous incidents have occurred. Dozing chauffeurs when hit with the heat beam make a rapid awakening, with the thought that their car is afire, while street cleaners think that their bags of papers have become ignited. At one place the truck drew up alongside a butter and egg store and a fair crowd gathered. Soon the proprietor came rushing out, figuratively tearing his hair and urging that the chauffeur move the appliance as it was melting the butter in his show windows.

This method of advertising has proved so successful that the New York Edison Company expects to use it for other appliances. For instance, during the summer months electric fans can be operated on the truck and at other times washing machines can be displayed and demonstrated on the street.

Service Companies Should Not Generate*

Day Is Fast Coming When the Manufacture of Electrical Energy Will Be the Specialty of the Producing Station, Which Will Sell at Wholesale to Local Utility Companies

BY SAMUEL FERGUSON
Vice-president Hartford (Conn.) Electric Light Company

IN ANY country or section of a country the progress and prosperity of its population can only be maintained if due attention be paid to natural conditions and if the people recognize and adapt themselves to changes in these conditions. Those who continue to work in the selfsame manner year after year and have faith that because it was best in their father's time it must be best today are bound to be quickly outdistanced by those who are capable of revising their methods to conform with changes of conditions which develop with so much more rapidity than most of us realize. This is particularly true in the electrical industry.

INDUSTRY IN NEW ENGLAND

New England is primarily an industrial community today, owing to the fact that before the days of the economical use of coal the multitude of its streams and water powers gave our fathers a natural advantage over other sections of the country in having a cheaper and more abundant source of power. Industries were located at available water powers all over New England, and the availability of the power was as a rule the determining factor in the selection of a location. For years the streams furnished sufficient power for our factories, and during that period our population acquired a degree of mechanical skill which enables us still to maintain our industrial position even after we have outgrown our streams and have come to be dependent on the coal fields of Pennsylvania for our power.

*Paper read before the annual convention of the Connecticut State Chamber of Commerce at Hartford.

EVOLUTION OF POWER

In the early days the waterwheel was very simple, though inefficient as compared with present-day standards, and as the factory was built around it, it was looked upon as one of the fundamental necessities of a manufacturing establishment. When steam engines were added to supplement the inadequate water power, the power plant naturally was still looked upon as the most necessary of all factory tools, and a factory without a power plant was an incomprehensible idea. During the past twenty years, however, this view has undergone a radical change, and today the leaders of practically all industries using power recognize that their shops can be better operated by purchased power, manufactured and distributed by the local electric company, than by an endeavor to operate a relatively small plant at each factory and conduct the manufacture of power as a side line to the manufacture of the particular line of goods on which the full attention of the management is concentrated.

CENTRAL STATION THE OUTGROWTH

This period of twenty years has seen this idea grow from a radical innovation and experiment until it has reached the state of a firmly accepted economic fact. It is simply a case of reaping the benefits of specialization and co-operation. Factories in every town have benefited and local electric companies, through the increased load used for twelve

instead of three hours, have been able to develop to a stage of economical production not otherwise possible.

Today conditions are again changing owing to the advance in the art of power manufacture. At the present time turbines which five years ago were looked upon as marvels of economy are far surpassed by efficient modern units of 20,000 hp. and 30,000 hp. However, few communities have sufficient load to justify the local electric company in installing such large units, and consequently there has recently grown up a practice of three or four communities being served from one power plant. While this is a step in the right direction, it does not go far enough. The manufacture of power is an art in itself and should be undertaken by those willing to make it their sole business. The business of manufacturing power should be entirely divorced from all problems of retail distribution and sale.

NEED OF SPECIALIZED PRODUCTION

I recognize that this is a radical idea because the power plant today is looked upon as the most important tool of an electric company, but I believe I am right when I say that an electric company whose primary function is to furnish satisfactory service to the public has no more business to operate a power plant than has a manufacturer of typewriters, drop forges, machine tools or any other commodity. Just as the electric companies have shown the manufacturers that they can purchase to better advantage than they can make their power, so must they in turn realize that they are mixing two radically different businesses when they endeavor both to furnish service to the public and to manufacture power.

I am firmly convinced that the maximum economy and reliability will not be accomplished until a single power-manufacturing company is created which shall take over and operate as a unified whole the power plants of the state which are now integral parts of the electric companies. Each electric distributing company would then purchase all its power at prices regulated by the state utility commission and would be free to concentrate its full attention and energy on its particular field of action, namely, the service of the public.

In order to supply their respective communities the principal electric companies of Connecticut have invested in power houses approximately $30,000,000. If they continue to develop independently, $15,000,000 more will probably be required in the next five years to keep pace with the requirements of the state. If, on the other hand, the principal plants can be controlled and operated by a single manufacturing company and all be connected by high-tension lines, there will be required less than one-half this amount of money for construction purposes, and the cost of power will be reduced by the saving of the fixed charges.

UNIFIED CONTROL

Moreover, with unified control of operation, the plants of maximum efficiency will always be operated to capacity instead of following the present practice, with every plant in the state operating twenty-four hours per day, which means loaded to only 20 per cent capacity for half the time. This saving alone would be more than sufficient to pay the fixed charges on the interconnecting lines. Such a company could readily absorb the surplus water power that now goes to waste for many months of the year.

Connecting the systems is not enough. The state needs a manufacturer of power whose business will be that and that only, and when this fact is realized to a sufficient degree, then will come the maximum efficiency in power production, and the public served by the electric distributing companies will greatly benefit. The day of electric service companies operating power plants is passing now just as truly as the day of the power plant as a necessary adjunct to a factory passed five or more years ago.

What Other Companies Are Doing

Sioux City, Iowa.—The Sioux City Gas & Electric Company, the majority of whose outstanding stock is owned by United Gas Improvement Company, is acquiring the electric generating plant and distribution system of the Sioux City Service Company, thus placing the entire electric light and power and gas business in Sioux City under one ownership.

Milwaukee, Wis.—Nearly $200,000 worth of electrical goods, ranging from electric sockets to washing machines, were placed on display and demonstrated to thousands of interested persons at the electrical show in conjunction with the fourth annual Food and Household Exposition from Oct. 23 to 29. This was the largest display of its kind ever held in this part of the country, representing thousands of the prominent makes of electrical appliances of seventy-five different manufacturers and dealers. Forty-five of these were local manufacturers or dealers in electrical appliances.

Montpelier, Vt. — General improvement in the granite industry is reported by the Montpelier & Barre Light & Power Company to Charles H. Tenney & Company, managers, Boston. During September the motor load increased by 459 hp. and there was a gain of sixty-eight lighting customers in this territory. Line extensions are being made and the outlook for better conditions is marked.

Jackson, Mich.—Surveys of meters, wiring, stoves and appliances are being made in all Michigan towns served by the Consumers' Power Company. Wherever necessary minor repairs are made and advice on major ones is given. The inspectors have been especially trained for this kind of work and are having a first-hand opportunity of finding out what the general public thinks of their utilities and of how they use them. They have found that the majority of consumers favor this co-operation and appreciate it.

Texas.—A course of study in the economics of public utilities has been inaugurated at the School of Commerce of the Southern Methodist University, Dallas, Tex., with a class of about seventy-five students. The course will comprise a series of lectures by a number of men prominent in the electric light and power industry in this section. The opening lectures will be "Interurban Railways," by James P. Griffin of the Texas Electric Railway Company, and "Electric Power and Light," by C. W. Davis, general manager of the Dallas Power & Light Company. These cover the phases of construction, operation and management. Later lectures will include similar topics, as well as matters of financing, regulation and accounting. The adoption of this course is another recognition by the colleges and universities of the need for more accurate knowledge of public utility problems.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

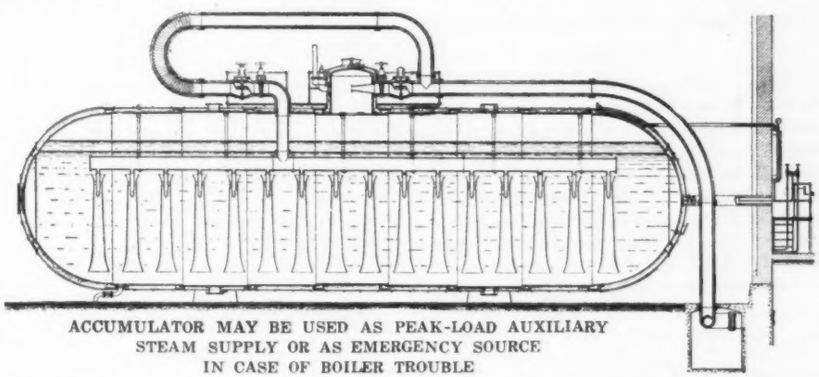
Generation, Control and Switching

Transformer Troubles in the Golpa Power Station.—W. PETERSEN.—Investigations of the cause of repeated failures on some three-phase, 17,000-kva., 6,300/110,000-volt transformers were made by the author, and it was found that the origin of these troubles was in the quick-breaking oil switches installed between the transformers and the outgoing lines. A detailed theoretical proof is developed, showing that in case of a quick rupture oscillations of between 3,000 cycles and 4,000 cycles may be established, which in turn are very liable to be the cause of considerable overvoltages. Oscillograms taken at the station under artificially made short circuits between two phases and corroborating fully the theory revealed the high frequency oscillations. It was estimated that the resulting overvoltage was about 250,000 volts. These tests were repeated several times during a period of several weeks and showed in every case the same results.—*Elektrotechnische Zeitschrift*, Sept. 28, 1922.

Use and Operation of Automatic Hydro-Electric Stations.—A discussion as to how the automatic station has solved the problem of developing small water powers, covering the types of stations, operation of a plant, protective devices and economies resulting from its use. One of the most important features of this type of station is the protective equipment applied to pre vent damage to the machine in case of trouble. These troubles and their remedies are briefly outlined.—*Power*, Oct. 3, 1922.

Hydro-Electric Development and Steam Equipment

Steam Accumulator.—P. MÜLLER.—Steam storage tanks in connection with intermittently operating steam-consuming machines like steam hammers, mine hoists, etc., are well known and widely used. The new steam accumulator system which is described is connected directly to the high-pressure steam line and operates on the principle of storing steam in water under increased pressure or releasing it under decreased pressure. A carefully adjusted valve between the boilers and the accumulator opens to admit steam if the pressure rises and releases steam if the pressure falls below a determined minimum. The storage tank may stand pressure variations of several atmospheres and may equalize the steam consumption within limits up to one to four or steam volumes between 5,000 kg. and 20,000 kg. It is possible in that way to use the accumulator as a peak-load auxiliary steam supply or as an emergency steam source in case of boiler trouble. The power station at Malmö, Sweden, makes an interesting use of such an accumulator. The plant derives its energy from a hydro-electric station, and in a substation near Malmö a steam turbo-generator is installed with this accumulator. Under normal operating conditions the generator runs idle as a power-factor-improving motor; but if there is any trouble on the line from the hydro station, the turbo set, driven temporarily from steam in the accumulator, assumes the generation, and the boilers, which are kept always under pressure, are fired to supply steam for the set. Enough steam is supplied from the accumulator to keep the turbo set running until the boilers are ready to deliver steam.—*Elektrische Kraftbetriebe und Bahnen*, Sept. 24, 1922.



ACCUMULATOR MAY BE USED AS PEAK-LOAD AUXILIARY STEAM SUPPLY OR AS EMERGENCY SOURCE IN CASE OF BOILER TROUBLE

Transmission, Substations and Distribution

Graphical Calculating Method for the Voltage Regulation of Long High-Voltage Transmission Lines.—E. SCHÖNHOLZER.—A short historical development of the Le Roy-Blondel series, with its graphical representation, is given, and based upon these a complete and extremely exact transmission characteristic diagram is constructed. It is explained how this vector diagram may be used for all possible line conditions, and a numerical example is taken to illustrate its use. The example is the three-phase, 110,000-volt, 230-km. transmission line from Seira to Barcelona, Spain, transmitting at present 25,000 kw. It is possible to read from the diagram directly the wattless compensating energy in kilovolt-amperes which is required to keep constant potential at the end of the line at a given load and power factor. The technical and economical advantages of a transmission line which is well regulated and fully compensated are pointed out.—*Schweizerische Techniker Zeitung*, Nos. 6 to 9, 1922.

Mechanical Properties of Commercial Iron.—ZAY JEFFRIES and E. S. ARCHER.—Definitions of various terms used in the art of testing materials are given with a discussion of how various circumstances surrounding the tests affect the results on annealed bars of common structural metals. — *Chemical and Metallurgical Engineering*, Oct. 4, 1922.

Points to Observe When Diagnosing Brush Troubles.—E. H. MARTINDALE.—The first of a series of five articles intended to analyze the causes and effects of evidence of brush trouble and the remedies that can be applied under a wide variety of operating conditions. In the first article a chart is reproduced that covers all of the common troubles and serves as a practical guide in studying them.—*Industrial Engineer*, October, 1922.

Units, Measurements and Instruments

Instruments Needed in Maintenance Work.—J. M. WALSH.—Practical suggestions on maintenance work in a factory to maintain the most up-to-date and efficient conditions possible in the equipment are pointed out. A complete set of electrical measuring instruments should be in the hands of the chief electrician. The most important of these are alternating-current and direct-current voltmeters and ammeters, current transformers, thermometer, photometer, Veeder counter, tachometer and spring balance. A lighting survey to check voltage and determine the intensity of illumination and the distribution and location of the sources of light, a motor survey covering a careful examination of every motor and a line survey covering an investigation of the different power and lighting mains and services throughout the plant should be included in the routine work.—*Industrial Engineer*, October, 1922.

Physical and Electrical Properties of Slate.—MERTON O. FULLER.—The main objects of the tests reported in this bulletin were to determine the physical properties of a so-called electrical slate and its special suitability for use in the electrical industries. The specimens were free from ribbons, had a fine, even grain, dense, compact structure, smooth cleavage and were freshly quarried. The article is thirty-four pages long and contains numerous tables, photo-

graphs and line drawings. In the tables are given the following tests: Chemical analysis, specific gravity, porosity, tensile strength, compression, flexure, toughness, hardness, coefficient of expansion, test to determine temperature at which cracks develop and ohmic resistance. The manner in which each of these tests was made is explained.—*Bulletin of the Fritz Engineering Laboratory, Lehigh University.*

Illumination

Lighthouse and Light-Vessel Illumination.—S. G. HIBBEN.—An extended investigation of the physical and practical aspects of lighthouse and light-vessel illumination has been made by the author, who presents data on the relative visibility under varying conditions. After a brief review of this type of lighting the structure of modern types of lamps is discussed and illustrated. The specialized requirements of the various classes of service are analyzed and the application of the illuminants for these are pointed out.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Why Miners' Portable Electric Lamps Require Safety Devices.—L. C. ILSLEY.—Several tests have been conducted in investigating the safety of the miniature electric bulb to demonstrate the danger of using these bulbs in explosive mine atmospheres unless the current that energizes the glowing filament be in some manner interrupted in case the glass surrounding the filament is broken. In fifty-five tests in which the naked filament was exposed either at the beginning or after smashing the bulb, fifty-one ignitions resulted. The bureau discourages the use of any modifications in lamps that interfere in any way with their proper operation.—*Series No.* 2371, *Bureau of Mines.*

Motors and Control

Multi-Motor Drive for Paper Machines.—W. STIEL.—The author describes several American and European methods of a multi-motor drive for paper machines. Using direct-current or induction motors for the individual drives, special synchronizing arrangements have to be employed to enforce a uniform speed of the different motors, for which purpose a number of regulating systems are available, such as tachometer dynamos, a combination of a differential gear and a regulating motor, an auxiliary synchronous motor, etc. In every case two belt-connected counter cones permit a change of the speed adjustment for each drive. A number of advantages are claimed for the individual drive, such as the omission of unreliable clutches, savings in floor space, no belting, higher economy (up to 20 per cent saving), greater accuracy of the maintenance of uniform pull on the paper, etc.—*Bulletin of Association Suisse des Electriciens*, September, 1922.

Utilization of Electric Power About the Blast Furnace.—GORDON FOX.—The processes about the blast furnace which require power are analyzed under the general headings "blowing," "pumping," "material handling," and "accessories." The article deals primarily with applications of the electric power to these processes, questions as to generation, conversion or distribution receiving mention only as they affect this application. Car dumpers, ore bridges, transfer cars and skip hoists are considered under "material handling."—*Electric Journal*, September, 1922.

Effect of Frequency Changes on the Characteristics of Polyphase Induction Motors.—J. K. KOSTKO.—A change of frequency affects all characteristics of a motor, but mainly the heating and power elements (maximum and starting torque and maximum power). The author shows that for any one of the power elements the ratio of values at two different frequencies depends only on the ratio of these frequencies and on a simple function of the motor constants. With the aid of curves that are given it is possible to find these ratios without any calculation.—*Electrician*, Sept. 15, 1922.

Heat Applications and Material Handling

Alloy Castings from Electric Furnaces.—L. J. BARTON.—The manufacture of nickel, chromium and chrome-nickel steel in the electric furnace as carried on in the Pacific Coast region is considered. Their production, properties and the methods of applying heat treatment is explained.—*Iron Age*, Sept. 28, 1922.

High-Speed Welding of Small Parts.—E. H. HUBERT.—Spot welding is finding increasing application as a substitute for riveting, staking and other methods of this nature. In this article a description is given of the semi-automatic electric spot-welding equipment used in the plant of the E. N. Garrison Manufacturing Company, Bridgeport, Conn., with an explanation of the procedure whereby 1,000 welds an hour are made. This process is applied to the manufacture of steel grease cups.—*Industrial Engineer*, September, 1922.

Electrophysics, Electrochemistry and Batteries

Electrolytic Oxidation of Isoeugenol.—ALEXANDER LOWY and C. M. MOORE.—A method for the preparation of vanillin by the electrolytic oxidation of isoeugenol was investigated. A series of experiments, using sodium hydroxide as the electrolyte, were conducted, and in every instance a negative yield was the result. Vanillin itself was found to oxidize readily electrolytically, and even if formed by electrolytic oxidation it would be immediately carried over into other products. Following the experiments it was concluded that if vanillin is produced by the electrolytic oxidation of isoeugenol, a totally different condition must prevail. Statements made in textbooks that vanillin can be prepared by this method should be modified or corrected.—*American Electrochemical Society paper*, Montreal, Sept. 21, 1922.

Electroplated Zinc and the Diffusion of Electro-Deposits Into Zinc.—WALTER G. TRAUB.—Experiments were made to determine the cause of the disappearance of certain metals that had been deposited on zinc. The results indicate that copper, brass, gold and silver are diffused into zinc, whereas nickel, which does not diffuse, can be used as a preventive against diffusion of other metals deposited over it.—*American Electrochemical Society paper*, Montreal, Sept. 21, 1922.

Traction

Rhaetian Railway Completes Electrification.—The operation of this Swiss road, which includes a network comprising 248 miles in the very mountainous canton of the Grisons, Switzerland, with many tunnels and heavy grades, was made possible only by electric power. The grades and tunnels over the different parts of the system are described.—*Railway Electrical Engineer*, September, 1922.

Experience with Chicago Track.—CHARLES S. HOLCOMB.—The types of construction used since 1907 and which have given very good results are described. The few changes in details found necessary to meet heavy duty are related, and the weighted life of track and special work and the relation between traffic and rail wear are given.—*Electric Railway Journal*, Sept. 23, 1922.

Telegraphy, Telephony, Radio and Signals

The Mercury Arc as an Audio-Frequency Oscillator.—YASUSI WATANABE.—This is a report of the experimental study of the mercury-arc method of producing sustained oscillation of radio audio-frequency. The arrangement of the apparatus is similar to Vreeland's oscillator, except that a magnetic field excited by direct current is necessary. With no magnetic field the oscillation is nothing but the oscillatory discharges of a condenser resulting from the fluctuation of the cathode spot of the mercury pool. On closing the magnet coil circuit, the nature of oscillation is immediately changed from electrical to mechanical, and the frequency of the ionic oscillation cannot be controlled by the constants of the oscillation circuit as in the case of Vreeland's oscillator.—*Journal of the Institute of Electrical Engineers of Japan*, September, 1922.

Radio Telephone for Power-Station Intercommunication.—R. C. DENNY.—Wireless provides emergency means of connecting the remotely situated power stations and construction camps with the operating headquarters when pole lines have been destroyed. The general problem is outlined and the advantages obtained from radio communication in this field are pointed out.—*Journal of Electricity and Western Industry*, Oct. 1, 1922.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Visual Illusions

By M. Luckiesh. New York: Van Nostrand Company.

If seeing were believing, the readers of this most entertaining volume would be suitable candidates for the psychopathic ward. As the author himself remarks, "Seeing is deceiving"; and while the eye plays true with the consciousness in a great many instances, it falls into habits of unqualified mendacity with an ease which could not be reckoned a credit either to nature or human nature. In fifteen interesting and also remarkably well-illustrated chapters Mr. Luckiesh manages to get together an amount and variety of information regarding optical illusions which is altogether astonishing to one who has never studied them.

The subjective character of color and color contrast is continually being illustrated in the study of luminous objects. Not only does the eye retain a visible memory of its experiences for perhaps several hours past, but it also carries a memory of contrast quite impossible to be overcome. Two mercury arcs at the ends of a photometer bar in a dark room generally look rather a good bluish-white. Extinguish one of them and light an incandescent lamp in its place and the tube turns bright green, while the incandescent lamp glows orange. Turn out the incandescent lamp and turn on the mercury tube and both tubes stay persistently green.

The consideration of the lighting of solid objects which Mr. Luckiesh gives is one extremely well worth studying by artists and architects. Many an admirable relief has been spoiled by unskillful lighting, which can flatten the most beautiful tracery into barely visible mediocrity. The applications of lighting in these fields have long been a special province of Mr. Luckiesh and his treatment of them is most effective. Altogether the book is a very interesting and admirable exposition of a most curious subject and will add materially to its author's already high reputation as a specialist in the lighting art.

LOUIS BELL.

The Diagnosing of Troubles in Electrical Machines

By Dr. Miles Walker. New York: Longmans, Green & Company. 450 pages, illustrated.

One expects to find an adequate and thorough treatment of this subject by Dr. Walker. Years of experience as a designer in this country and in England and other years of teaching and consulting experience at the University of Manchester have admirably fitted him for the task.

The book is based on this experience of thirty years and incorporated the following sound advice: "First find out the facts; see the thing yourself; let your conclusions be drawn from ascertained data and not from supposition." The scope of the book is very wide, covering the breakdown of insulation, overheating, low efficiency, regulation, balance, commutation, the use of vectors and of the oscillograph as applied to alternating-current and direct-current motors of all types. The illustrations and engineering data and the methods outlined are good for all makes of machines. The volume is a welcome contribution from an authority, written in a very logical and interesting manner. It is the type of book that every electrical engineer will find valuable and interesting.

Electrical Engineering Testing

By G. D. Aspinwall Parr. New York: E. P. Dutton & Company. 692 pages, illustrated.

This book is well arranged as a reference book on electrical engineering and in many institutions could be used as a textbook for test work. A large number of tests are arranged to cover the field of meters, resistance measurements, insulation, alternating-current circuits, magnetic circuit and phenomena, besides transformers and both direct-current and alternating-current machinery.

Each test is arranged with a brief discussion of the theory pertaining to it and the relative advantage of the test. A list of the apparatus required is given together with a diagram of the connections. The required observations are described, and a suggested arrangement of data makes it easy for a student to form the habit of careful and orderly work. Where desirable, suggestions for manipulation are included. A valuable portion of each test, which in many cases could have been amplified, is the suggestion of deductions for the student to make from the observations. For some experiments these are definite, while with other tests the suggestions are very general, but in any case they encourage the student to study the results and particularly the curves obtained.

These brief guides for the tests quite naturally take the larger portion of the book, but nearly 200 pages are devoted to other very valuable information. Several pages are devoted to the proofs of common formulas to be used by the student as a check of his work. More than a hundred pages are utilized to describe apparatus used for tests, explaining the principles involved. Various types of instruments, dynamometers, etc., are described. Some of this apparatus is specially constructed, which makes the description more desirable.

Another valuable section is the tables which give conversion factors, squares, reciprocals, logarithms, etc. There are also tables giving the properties of copper and other alloys, these alloys being of English manufacture. The index is well arranged and materially increases the value of the book for reference work.

R. G. WARNER.

Properties of Electrically Conducting Systems, Including Electrodes and Metals

By Charles A. Kraus. New York: The Chemical Catalog Company, Inc. 403 pages, 70 illustrations.

This book is one produced in the Monograph Series of the American Chemical Society and gives a complete treatment of ionic conducting systems. Metallic systems are included because of the intimate relations existing between the phenomena in metallic and electrolytic systems. An empirical treatment has been selected because the author cannot reconcile all the phenomena with any of the theoretical hypotheses extant.

The author classifies conductors, solutions and solvents and briefly gives the fundamental conceptions of electricity, matter and the ionic theory. The conductance of solutions and the form of the conductance function in their effects and as affected by materials, viscosity, solvents, temperature and concentration are admirably treated. The discussion of homogeneous and heterogeneous ionic equilibria covers the ground very thoroughly.

One of the most interesting portions of the book is that devoted to a critical and constructive discussion of the various theories relating to electrolytic solutions. The author points out that strong and weak electrolytes do not conform to the same law, that the hypothesis of complete ionization of electrolytes lacks experimental support and that the conductance changes in electrolytes with concentration percentages and has a variable behavior in low-capacity solvents. He concludes that elements of truth exist in each theory, but that work must still be done to rationalize the complete theory.

Books Received

Electric Transients. By C. E. Magnusson, A. Kalin and J. R. Tolmie. New York: McGraw-Hill Book Company, Inc. 190 pages, illustrated.

Advanced Laboratory Practice in Electricity and Magnetism. By Earle Melvin Terry. New York: McGraw-Hill Book Company. 258 pages, illustrated.

Connecting Induction Motors. By A. M. Dudley. New York: McGraw-Hill Book Company. 244 pages, illustrated.

Pulling Together. By John T. Broderick. Schenectady, N. Y.: Robson & Adee. 141 pages.

The Origin of Spectra. By Paul D. Foote and F. L. Mohler. New York: The Chemical Catalog Company, Inc. 241 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Lack of Personnel Hinders Power Board Valuation

Evaluation of the properties of the Niagara Falls Power Company by the Federal Power Commission apparently has been suspended. When the work was started it was understood that the object was as much to determine what is involved in the evaluation of such a plant under the proposed accounting regulation of the commission as it was to determine the actual value of this particular property.

Before the government accountants had proceeded far with their work a number of points of controversy arose which resulted finally in the power company appealing to the commission for a hearing, and, although no official expression in regard to the matter has been made, it is believed that the commission will suspend the work until a number of matters of policy have been decided. It also is possible that the resumption of the work may await the action of Congress in providing suitable personnel for this phase of the commission's duties.

The commission has proceeded actively in the discharge of all of the other tasks assigned to it by the water-power act. In the matter of making valuations, however, it has been apparent that work could not be undertaken on an intelligent basis without the employment of specially qualified men.

Alabama Power's Rates Are Voluntarily Lowered

The Alabama Power Company lately asked the Public Service Commission of the state to allow it to reduce the price of electrical energy to residential consumers approximately 8 per cent, to take effect Nov. 1, and President T. W. Martin then asserted that the lower rate would go into effect on that date whether the commission had rendered its decision or not. The new rates affect 20,000 customers in Alabama. They do not affect residential consumers in Birmingham, however, owing to the fact that the company sells its energy at wholesale to the Birmingham Railway, Light, Power & Fuel Company, which retails it to the residential consumers.

The new rates are 10 cents for the first 30 kw.-hr., 8 cents for 170 kw.-hr. additional, 7 cents for 300 kw.-hr., 6 cents for 350 kw.-hr. and 5 cents for all over 350 hours. Mr. Martin said: "We have filed the new rates because of the growing demand throughout the state for electricity in the homes for a variety of uses, especially for cooking purposes."

St. Croix Disputants Before Wisconsin Commission

Agents of the city of St. Paul and representatives of the Marcom Kelsey-Brewer interests of that city combined to fight before the Wisconsin Railroad Commission recently the request of the St. Croix Falls Development Company, a Byllesby utility, for power rights on 40 miles of the St. Croix River above St. Paul, and action was delayed until the Kelsey-Brewer interests shall file a petition for permission to build a single dam across the river, which forms part of the boundary line between Wisconsin and Minnesota. The Kelsey-Brewer interests hold title to sites on both sides of the river.

The hearing was on the application of the Byllesby interests for permission to raise the Nevers dam and to construct two additional dams to utilize the 40-mile stretch of the St. Croix above St. Paul. Both the St. Croix Falls Development Company and the St. Paul organization now have applications before the Federal Power Commission for permission to build dams.

Sioux City Public Utilities Combine

A merger of the Sioux City Service Company with the Sioux City Gas & Electric Company was completed at Chicago on Nov. 2, in accordance with an ordinance passed by the City Council and approved by the people of Sioux City on Aug. 28. E. L. Kirk, general manager of the first-named company, was elected president to replace R. J. Dunham of Chicago, resigned. William J. Bertke, secretary and assistant manager of the Sioux City Gas & Electric Company, has been appointed vice-president and general manager of the new company, which will retain the name of the Sioux City Service Company. He will have direct charge of the operation of the electric service as well as of the street-railway, steam-heating and gas departments.

Following the merger, Mr. Bertke said that a contract had been signed with the Iowa Light & Power Company, with state headquarters at Carroll, to furnish service to about seventy towns north and east of Sioux City and that it would be the aim of the consolidated company to occupy a place in the forefront of Middle Western utilities.

California Defeats Water and Power Act

Majority of Nearly Two to One Rolled Up Against State-Ownership Amendment to Constitution—Amendments Extending Commission Control Over Municipal Plants Fail to Carry

THE people of California at the election on Tuesday, Nov. 7, declared themselves in no uncertain terms on the proposed constitutional amendment known as the water and power act, which would have pledged the credit of the state to the extent of half a billion dollars to engage in the business of developing hydro-electric power. Incomplete returns indicate that the measure has lost by nearly two to one. The election was the culmination of a very bitter fight waged by the proponents of the measure for its passage. Their campaign all the way through was characterized by insinuations of graft, exorbitant profits and misrepresentation of the stand of the power companies, and the power interests were accused of trying to build up a political machine and create a monopoly by which they could control the state.

Briefly, the act provided for the control of the water powers of the state by a board of five, to be appointed by the Governor, which would have at its disposal $500,000,000 to be raised by the sale of bonds and backed by the credit of the state. This money could be used at the discretion of the board to develop and distribute water and electrical energy and, if deemed expedient, for the acquisition of the power plants and distribution systems of privately owned utilities.

Two other measures of interest to the electrical industry of the state have apparently lost by majorities too large to be overturned when the complete returns are counted. One was an act to bring municipally owned utilities under the jurisdiction of the California Railroad Commission and to give the commission the power of regulation in all matters except the issuance of securities. The other was an act requiring municipally owned utilities to pay the same tax that is required of privately owned utilities.

Plans of Southern Power

New High-Tension Lines 200 Miles in Length—System Rating to Be Increased to 600,000 Hp.

IN ANTICIPATION of the completion next year of two new hydro-electric plants and two steam-plant additions, which will give an additional total generating capacity of 200,000 hp., the Southern Power Company is pushing to as rapid a completion as possible the construction of new high-tension transmission lines more than 200 miles in length. This extension of lines, exclusive of transformers, switches and incidental equipment, will cost approximately $2,000,000.

The longest and one of the most important of the new transmission lines is being built from Lookout generating station, west of Statesville, to Winston-Salem, High Point and Greensboro, a distance of 75 miles. Another important line is being built from Great Falls, S. C., where the new Dearborn hydro-electric station will soon be completed, to Newberry. S. C., a distance of 50 miles. A new line, 40 miles in length, is being built from the large new Mountain Island plant to Salisbury. A similar line is under construction between Mountain Island and Gastonia. Another line which will serve Gastonia is being built from the Mount Holly steam plant. A line is also being built from the Mount Holly steam plant to the Mountain Island hydro-electric plant. A new line is being built from Shelby to Caroleen, and still another from Hickory to Rhodhiss.

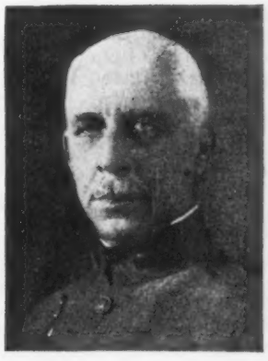
The steam-plant additions will be at Mount Holly, where equipment will be installed to generate 40,000 hp., and at the Eno power house at University Station, N. C., the capacity of which will be increased 20,000 hp. Of the new hydro-electric installations, the Dearborn plant, at Great Falls, S. C., is expected to be ready for operation by next March and the Mountain Island station, near Mount Holly, N. C., will probably be ready for operation in August.

The company began signing contracts for power in anticipation of new developments immediately after contracts were let for the Mountain Island and Dearborn stations. Applications for more than 35,000 hp. were already on file, and since work has started the demands for prospective power have been so active that the company has sold all the power it dares sell against its new developments, so that the power situation today is approximately what it was a year ago; that is to say, there is no power in prospect beyond the amount which is already under contract.

The Southern Power Company has at present generating capacity in its hydro-electric and steam plants very nearly totaling 400,000 hp. The present transmission system of the company embraces approximately 2,200 miles. When the new lines are completed the total mileage will be approximately 2,400.

American Delegates to International Electrotechnical Commission, Meeting at Geneva, Switzerland, November 20

C. O. MAILLOUX
Consulting Engineer,
New York



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Meter and Test Department,
New York Edison Company

CLAYTON H. SHARP
Technical Director Electrical
Testing Laboratories,
New York

H. M. HOBART
Consulting Engineer,
General Electric Company

Coal Situation Worse

Public Utilities Not Getting Enough Fuel to Permit Proper Reserves—High Prices in Middle West

DESPITE reassuring statements from the Department of Commerce and from the Federal Fuel Distributor, representatives of the public utilities contend that the coal situation, so far as their plants are concerned, is getting worse instead of better. The figures of the American Railroad Association are attacked as being inaccurate, a belief being expressed in public utility circles that there are duplications in the figures as to car loadings. Since the utilities are hampered by fixed incomes in bidding for coal against manufacturers, they believe nothing short of the re-establishment of class No. 2 priority will enable them to build up the reserves necessary to carry them through the winter.

Eastern and Middle Western utilities have been asked to await the closing of the lakes before attempting to build up storage. They contend, however, that the closing of the lakes will mean that freezing weather has arrived and that a tonnage far in excess of that moving up the lakes will have to be delivered to domestic consumers. Moreover, the advent of cold weather means that the railroads will be 20 per cent less efficient. Transportation disability, the public utilities contend, will be even greater this winter because of the shortage of motive power and the run-down condition of locomotives and cars.

The point on which the public utilities are placing most emphasis in their representations to the Fuel Distributor and to the President's coal commission is that deliveries on their contracts frequently are as low as 15 per cent, while in only rare instances are they exceeding 50 per cent. The high prices being paid for coal in the Middle West have unbalanced the transportation movement from Eastern mines, and this situation is further curtailing the chances of the public utilities to accumulate reserves sufficient to insure the proper margin of safety.

State Commissioners to Confer on Rural Extensions

A round-table conference on rural extensions of electric light and power service will be one feature of the thirty-fourth annual convention of the National Association of Railway and Utilities Commissioners, which will be held at Detroit next week at the Hotel Tuller, beginning Tuesday, Nov. 14, and continuing until Friday. Henry G. Wells of the Massachusetts Department of Public Utilities will on Wednesday present the report of the committee on this subject, and it will be discussed by Sherman T. Handy of the Michigan Public Utilities Commission, H. A. Russell of the Kansas Public Utilities Commission and other commissioners.

Other matters to come before the convention will be co-operation with the Interstate Commercial Commission in arriving at an understanding of policy in transportation cases where federal jurisdiction and state jurisdiction meet, the regulation of the telephone business, and state and federal regulation in connection with depreciation. On Thursday M. H. Aylesworth, executive manager of the National Electric Light Association, will make an address on "Public Relations," Martin J. Insull will talk about utility problems, and Frank W. Smith, president of the N. E. L. A., will describe the work of furnishing light and power in the metropolis. O. C. Merrill, executive secretary of the Federal Power Board; Carl D. Jackson, retiring president of the National Association of Railway and Utilities Commissioners, and C. C. McChord, chairman of the Interstate Commerce Commission, will be among others prominently connected with utility regulation, who will be heard from.

Tacoma to Proceed with Lake Cushman Project

Work on the plans and specifications for the Lake Cushman hydro-electric project of the city of Tacoma, Wash., will begin immediately upon completion of the steam plant on the waterfront, according to an announcement by Commissioner Ira S. Davisson. All legal obstacles preventing the city from proceeding with this project have been overcome, and the long litigation in the courts was ended by a recent decision of the Supreme Court of the State of Washington upholding the right of the city to condemn state lands for public use.

Plans for the entire project will be prepared, although it is planned to install only one unit at the present time. This will include a power plant at the dam, with a transmission line into the city, costing approximately $3,000,000 and requiring about eighteen months to complete.

Pittsburgh's Electrical Show

An entire electrical home with all the rooms and appurtenances necessary to the modern household, and electrical fountain containing twenty thousand varicolored jewels which formed a lamp shade about a column of water shot 50 ft. in the air from an illuminated pool, a continuous radiophone broadcasting demonstration and a search-lamp mounted on the roof and capable of throwing a beam of light more than 80 miles were leading features of the electrical exposition held in Motor Square Garden, Pittsburgh, from Nov. 4 to Nov. 11. Manufacturers of apparatus, appliances and industrial applications all over the country and local jobbers and dealers co-operated in planning the exposition, which included all the usual exhibits and educational features of such affairs. It was planned and carried out by the Electric League of Pittsburgh.

Los Angeles Seeks License for Owens Gorge

The city of Los Angeles has altered its application to the Federal Power Commission in connection with its Owens Gorge project so as to ask for a license instead of a preliminary permit. Action on this application is being withheld pending the outcome of litigation between the city and the Southern Sierras Power Company. A verdict in that suit is expected within a few weeks. If the verdict is favorable to the city, it is believed it will begin in the near future the extension of its aqueduct system and the development of the additional power covered by previous applications. The total approximates 150,000 hp. When to that total is added that of the Haiwee project and the two San Francisquito plants a total development of about 300,000 hp. in connection with the water-supply system of the city is indicated.

The application for license covering the Haiwee project was only recently submitted to the commission. It covers the construction of a power plant in Haiwee Narrows, 2 miles below the Haiwee Reservoir on the Los Angeles aqueduct.

State Delay Hampers Water-Power Financing

That part of the water-power act which provides for a sort of dual control by stipulating that the state law must have been complied with before a license is issued presents an avenue through which an obstructionist may work. The possibilities in that connection have just been brought out in connection with the handling of the license for the Clarion River Power Company. A license was authorized on Sept. 11, but its execution was delayed for weeks by the failure of the Pennsylvania State Water Supply Commission to approve the plans of the application. This failure of the commission's officials to approve the plans, although its engineering division had reported that they were in proper form and entirely satisfactory, all but upset the carefully laid plans which had been made for financing the project.

Whatever may have been the reason for the long delay in approving these plans, it tended to accentuate the fact that public officials frequently are indifferent to the effect that delays may have on a business negotiation. There are times when an eleventh-hour obstruction of the machinery which grinds out water-power licenses will cause very serious financial embarrassment to the prospective licensee, since the raising of the large sums required for building dams and power houses constitutes in itself a delicate process.

State officials, however, are usually found eager to facilitate any local development, and thus far the Federal Power Commission has found them ready to co-operate with it.

Power Club Proceedings

"Handbook" to Be in Two Parts—Ship Electricians, Manufacturing Census and Temperature Rating

ONE of the last acts of the Electric Power Club at its recent convention at Asheville, N. C., which was reported in part in last week's *Electrical World*, was to decide to issue the "Handbook" in two parts. One part of the new "Handbook" will be the standardization rules of the Electric Power Club, including adopted standards, recommended practices and recognized departures, this part of the book to be available for general public distribution. The other part of the "Handbook" will include that part of the present book which is composed of the constitution and bylaws, rules of procedure, list of member companies and representatives, and one page to each member for listing of products manufactured, officers, etc. This part of the "Handbook" will be principally for distribution to members of the Electric Power Club.

As a byproduct of the work of one of the committees it was brought out that at the present time there is no arrangement for the examination and licensing of electrical men to take care of electrical equipment on board ships, and that it seems advisable for the electrical industry to take action to help provide a suitable status for such men, on account of the rapidly advancing utilization of electrical equipment on shipboard.

After an extended discussion pro and con there was a consensus of opinion that the census committee should work out a means of supplying statistical reports to the Department of Commerce, on the assumption that a sufficiently representative group of manufacturers would supply this information. The Department of Commerce has offered its services in gathering and distributing such information.

The anticipated discussion on the 40-degree versus 50-degree rating question led to no definite conclusion or agreement as to a single rating. There was, however, a unanimous opinion expressed that the present two standards of rating should not be continued if an agreement can be had upon a single standard. The committee was instructed to continue to try to find a single standard upon which the members of the club could unanimously agree.

Utility Advertising Association Joins World Clubs

The national advertising commission of the Associated Advertising Clubs of the World at a recent meeting in Chicago admitted to membership the Public Utility Advertising Association, organization of which began during the convention of the Associated Advertising Clubs in Milwaukee last June. The action of the commission came soon after the presentation of the association's claims for membership, following a round-table conference of utility advertising and publicity men during the annual convention of the American Electric Railway Association in Chicago early in October. The Public Utility Advertising Association will as the result of this action go to the annual convention of the parent organization at Atlantic City next June with a complete program of its own and will also participate in the general sessions of the convention.

The members of the new association will include advertising men of the electric light and power, manufactured gas, telephone and street-railway industries, representatives of the various state committees on public utility information and representatives of the national associations of the various utilities.

Asks Transfer of Permit

Pacific Coast Company Seeks to Acquire Privilege Granted by Power Board to Another

AN UNUSUAL situation confronts the Federal Power Commission regarding a preliminary permit which, after hearings and negotiations covering two years, it authorized for two projects on the Deschutes River on the application of the Columbia Valley Power Company. The permit has not yet been executed, but two weeks after its authorization the Bend Water, Light & Power Company of Bend, Ore., appealed to the commission to transfer to it the Metolius site, one of those covered by the application of the Columbia Valley Power Company. The Bend company desires to utilize a maximum of 86,000 hp. for irrigation and to feed the remaining primary power, and during the non-irrigation season a part of the power which is not required for pumping, into its existing system in central Oregon. It has plans for developing a large domestic heating load at low rates. In addition there are prospects of increases in the industrial load, particularly in the electrical energy required in the manufacture of wood pulp.

The Bend company contends that since it is in a better position to utilize the power than the rival applicant, the commission should reverse its action and award the preliminary permit to it. The chances, however, are against any reversal.

ANOTHER CALIFORNIA PROJECT

M. C. Seagrave of 593 Market Street, San Francisco, has applied for a preliminary permit covering a combined power and irrigation project, including a dam and reservoir on the headwaters of the North Fork of the Consumne River. The water is to be conducted through a canal 5 miles long to a power house on the same stream. The primary power that can be made available is estimated at 10,000 hp. It is the intention to install machinery sufficient to develop 13,000 hp.

San Francisco Engineers Celebrate in New York

A reunion was held in New York recently to celebrate the tenth anniversary of the Engineers' Club of San Francisco. This organization was founded in 1912 to provide headquarters and a meeting place for engineers in connection with the Panama-Pacific Exposition, held three years later, and now is a flourishing club with headquarters at San Francisco.

W. W. Briggs of the Westinghouse Lamp Company is a past-president of the club and called together about fourteen non-resident members at the office of A. H. Griswold, assistant vice-president of the American Telephone & Telegraph Company. Here congratulations were exchanged by long-distance telephone with the Pacific Coast headquarters, where about 150 club members enjoyed the transcontinental reunion.

Those participating in the New York reunion were Guy C. Bailey, A. M. Hunt, Allen Hazin, A. H. Griswold, S. G. DeRemer, C. C. Broadwater, F. W. Gay and W. W. Briggs. Among those talking at San Francisco were W. G. Vincent, Jr., Charles Merrill, George Dillman, A. H. Babcock, Robert Sibley and A. H. Halloran.

Meter Readers, Truckmen and Linemen Sell Washers

According to telegraphic advices from Portland, Ore., the Pacific Power & Light Company, with operating headquarters in Portland, conducted a most successful washing-machine sales campaign during October. The company serves about 24,000 residential customers in seventeen smaller communities in Oregon and Washington and, although electrical devices are already well distributed in the community, 355 more washers were sold during the month in this campaign. The best previous month's record on the Pacific company's system was in October last year, when 236 washing machines were sold.

The outstanding feature of the campaign is that the men who led in sales were meter readers, truckmen and linemen who were accustomed to entering the homes of the customers and meeting the housewives. It is pointed out that this is proof that the central station with a complete organization, whether in the sales, line or meter department, and with one objective, can accomplish what is wanted. The largest city served by the Pacific company has a population of only 18,000. This is a representative community; and while it has only 654 electric residential customers, fifty washers were sold in this town during the month.

The officials who directed this campaign are Lewis A. McArthur, vice-president and general manager; John B. Strange, assistant general manager, and H. B. Moon, appliance sales superintendent.

Court Halts Work in Disputed Wisconsin Territory

Pending the settlement of a dispute before the Wisconsin Railroad Commission between the Badger Public Service Company of Elkhart Lake and the Eastern Wisconsin Electric Company of Sheboygan over the right to build a line to serve the town of Calumet, the Circuit Court has issued an order halting the activities of both companies in the territory named. The Badger Public Service Company maintained that it had taken over a franchise from the Malone Light & Power Company which gave it the right to operate in this territory. To this the Eastern Wisconsin attorneys replied that no work had been done under the franchise within the year specified by the law for the commencement of activities under public service franchises and that therefore the franchise was void. The Badger company's representatives asserted that the statute cited did not apply since it was passed before the grant of the Malone company's franchise and related specifically to franchises granted prior to the enactment of the statute.

British Engineers Unite in Joint Council

Influenced in some degree, it is thought, by the establishment in America of the Federated American Engineering Societies with their Engineering Council, the engineers of Great Britain have formed an Engineering Joint Council consisting of representatives of the Institutionof Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects and the Institution of Electrical Engineers. Among other objects, the joint council, as stated in the announcement of its formation, will strive to improve the status of engineers, to insure the better utilization of their services in the interests of the nation and the appointment of properly qualified individuals to responsible engineering positions, and to prevent the unnecessary duplication of activities.

This Engineering Joint Council will co-operate with the Federated American Engineering Societies' committee on affiliation with engineering societies outside of the United States in establishing direct contact between American and British engineers. The F. A. E. S. committee has already established contact with engineering bodies of France, Italy and Czecho-slovakia.

West Virginia Coal Operators Seek Lower Power Rates

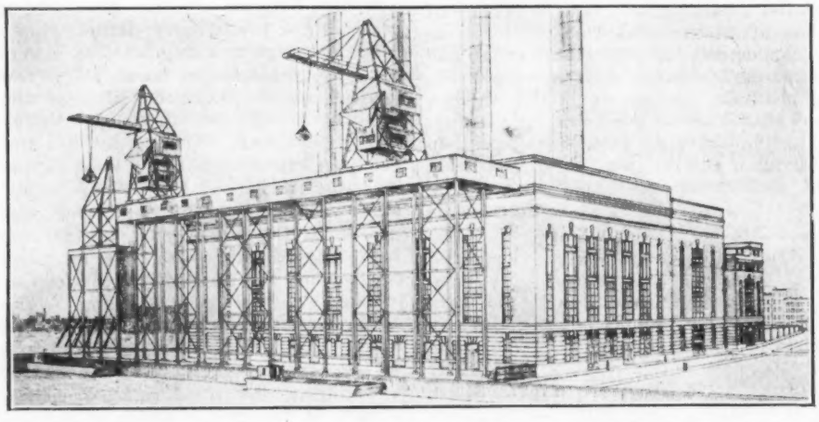
A reduction of 30 per cent in their monthly bills is sought by a large number of coal-operating companies in the Winding Gulf, Pocahontas and Tug River coal fields of West Virginia, and proceedings in a complaint lodged by them with the Public Service Commission of the state against the Appalachian Power Company have been pending since February, the brief of the coal operators' attorneys being finally filed last week, after voluminous evidence had been taken. Much interest is manifested in the case by power companies in West Virginia and adjoining states.

Nearly every principle of utility regulation is involved. The petitioners claim that the value of the company's property for rate-making purposes ascertained from the actual cost record in the power company's books is approximately $12,000,000. The power company claims this value to be between $17,000,000 and $23,000,000 on the "reproduction new" theory. There is also a wide difference of opinion between the petitioners and the respondent as to the propriety of charging numerous items to operating expense.

Innovations in New Brooklyn Power House

Compactness of Record-Rating Turbines, Novel Switch Installation, Method of Heat Balance, Generator-Transformer Units, High-Voltage Transmission to Substations

ADDITIONAL information has just been made available regarding the new 400,000-kw. steam-turbine station under construction by the Brooklyn Edison Company. Aside from the record rating of the turbines to be installed, this plant is notable for the size of its boilers, the relatively small increase in size of turbines for their rating, the method of obtaining heat balance, the connection of generators to transformers without intervening switches, the extent of the use of high voltage for transmission underground to the substations, the method of isolation of phases and the use of an entirely new type of switch installation.



NEW POWER HOUSE OF BROOKLYN EDISON COMPANY, NOW UNDER CONSTRUCTION

Only one-half the ultimate building will be erected for the present, the boiler room next to the river, the turbine room and separated switch and bus house and the coal-storage space farther inland. Coal will be received by water and conveyed to the overhead bunkers by electrically operated coal towers. The overhead bunkers will accommodate four days' fuel supply under ordinary operating conditions. Traveling lorries will distribute the coal to the stokers. Six of the stokers purchased for the first installation will be Westinghouse and two Combustion Engineering. For the time being eight 19,650-sq.ft. B. & W. boilers will be installed. Ashes will be carried from beneath the furnaces to an outside under-water storage pit by hydraulic sluices, from which they will be hoisted to a concrete ash bunker and flow by gravity to ash scows.

Steam will be delivered to the turbine throttles at 265 lb. pressure and 200 deg. superheat. Both of the turbine-alternators are rated at 62,500 kva., 80 per cent power factor, one being a Westinghouse-Parsons tandem compound unit and the other a General Electric-Curtis unit. The Westinghouse turbine is about the same length as the 40,000-kw. turbines previously developed by the Westinghouse company, the increased power being obtained primarily through increasing the diameter of the bucket disks gradually rather than in steps and by the use of a cone-shaped drum barrel instead of cylindrical drums increasing in diameter by steps. The Curtis turbine is about the same length as the 50,000-kva. 90 per cent power-factor machines developed for the Detroit Edison Company, and it embodies all the results of the intensive research and experimental work carried on by the General Electric Company in the last two years. Both turbines will embody the latest refinements in disk and bucket construction, sealing glands, etc.

At full load (50,000 kw.) the Westinghouse Parsons unit has a guaranteed water rate of 10.44 lb. per kilowatt-hour, while the General Electric-Curtis unit has a guaranteed rate of 10.45 lb. per kilowatt-hour. The most economical water rate—namely, 10.04 lb. per kilowatt-hour—is obtained at 40,000

kw. load with the General Electric unit. In the Westinghouse unit the best economy is obtained at 36,000 kw. and is 10.1 lb. per kilowatt-hour.

Exceptionally large condensers are used, having 70,000 sq.ft. of cooling surface, both being supplied by the Westinghouse company. The condenser for the Westinghouse turbine is provided with rubber expansion joints and supported from the girders under the turbine. That for the General Electric turbine has rubber expansion joints but is supported by springs from foundations on the basement floor. Two circulating pumps are provided for each condenser, each rated at 50,000 gal. per minute. All the auxiliaries are electrically driven except one-third of the boiler-feed pumps, which are turbine-driven.

GENERATOR AND TRANSFORMER UNIT

The generators are rated at 13,800 volts, 60 cycles, and, as stated before, are connected directly to auto-transformers stepping up the generator voltage to 27,600 without intervening oil circuit breakers, thus making each turbo-generator and corresponding transformer a unit. This voltage of 27,600 is adopted owing to the congested sub-surface street conditions in the vicinity of the station and the greater economy of transmission at this voltage for the distances encountered in Brooklyn.

Vertical isolated-phase construction was adopted for the electrical gallery; that is, phase switches A, B and C with their corresponding buses are situated on separate floors one above the other. This arrangement not only reduces the building space to the smallest dimensions but assures also reliability of operation and permits the adoption of special facilities for switch handling and easy inspection.

Special-type oil circuit breakers were designed by both the General Electric Company and the Westinghouse company to meet the requirements laid out by the engineers of the Brooklyn Edison Company.

The oil circuit breakers are of the dead-tank type, insulated for 37,000-volt operation, and each breaker is provided with bushing-type current transformers of high accuracy. The elimination of current-transformer compartments will save considerable space in the ultimate installation. The generator bus-tie and group-feeder breakers are to be capable of interrupting 1,500,000 kva., and the feeder breakers, which will be in series with feeder reactors, will have an interrupting capacity of 500,000 kva.

Each circuit breaker with its connections to the bus forms a cubicle and is hung on "I" beams from the ceiling, thus eliminating all barriers, bus, disconnecting-switch and circuit-breaker compartments. The operating mechanism is mounted on the top floor above the phase switches, while below them on the ground level are the potential transformers and grounding and testing switches. The potential transformers and grounding and testing switches are to be of the compound-filled type with no live parts exposed.

Screw rods operated by the mechanism on the top floor and extending down through the phase switch floors make it possible to lower each switch 15 in., thus completely disconnecting it from the bus. By this means all disconnecting switches have been eliminated. In this position the breaker may be removed, making replacement of parts very easy. Further operation of the lowering screws drops the tank so that all of the inside parts can be inspected. All operating parts of the switch are so arranged as to permit operation in the lowered position.

With the exception of the motors requiring variable speed, such as stoker and clinker-grinder drive, forced-draft fans and coal hoists and cranes, the auxiliary drive in the plant will be of the alternating-current type. The forced-draft fan motors and the coal-hoist motors will be operated with the Ward Leonard type of control. Motor-generator sets will be provided for supplying the direct current, the motors being supplied from the 2,300-volt bus.

The heat balance for this station will be obtained automatically by bleeding the turbines at two points into high-pressure and low-pressure closed heaters. The condensate from the main turbine will be used first to condense the exhaust steam from the house turbine, after which it will pass to the suction of the boiler-feed pumps, on which line the surge tanks also float.

The auxiliary power will be derived from three sources—power transformers fed from the high-tension bus, house turbine-generators and a reserve source of energy from a frequency-changer set which will be driven from the 25-cycle Gold Street station.

Program of Credit Men's St. Louis Meeting

For the twenty-seventh annual meeting of the Electrical Credit Association, Central Division, to be held at the Gatesworth Hotel, St. Louis, Nov. 16 and 17, the tentative program includes the following features:

THURSDAY, NOV. 16

Morning.—Reports of officers and regional directors on trade conditions; election of officers; "Collection Troubles and Cures," August L. Abbott.

Afternoon.—Entertainment.

Evening.—Annual dinner; speakers, State Attorney-General Jesse W. Barrett, "Ethics in the Conduct of Business"; Rev. H. L. Reader, "Fellowship"; John S. Leahy, "Electricity and Credits."

FRIDAY, NOV. 17

Morning.—"Making Salesmen of Credit Men," F. B. Whitlinger; "A Credit Man's Road Experiences," A. F. Hearl; "C. O. D. Problems," V. G. Fullman; "Service Snags and Solutions," Miss S. J. Burchill; "Value of E. C. A. Membership," W. P. Johnson; "When and How to Use the E. C. A. Forms"; Experience meeting and general discussion.

Afternoon.—"Creative Credit Management"; "Credit Work and Credit Letters," M. A. Patterson; "Ways to Make Money for the House," F. E. Watts; "Radio Problems," J. D. Meek; "Credit Insurance Experiences"; general discussion.

Brief News Notes

New Plant for Dallas.—The Dallas (Tex.) Light & Power Company has, it is announced, purchased a tract adjoining its present power plant on which it will construct an addition to house a 15,000-kw. unit, making its total available capacity 37,000 kw. The new plant will cost approximately $2,180,000, which with new substations and lines will bring the cost of improvements to $3,000,000. Work will start about Jan. 1, 1923.

Presumpscot River Power Exhausted. With the building of a new 1,000-kw. generating plant on the Presumpscot River, in Maine, now under way, by the Mallison Falls Power Company, which has leased the water rights of the Windham Manufacturing Company, it is said that virtually all the water power available from the river named will be utilized. The new plant will be of double the capacity of the company's present plant on the other side of the river.

Los Angeles Consumers Get Refund.—The Southern California Edison Company has been directed by the Railroad Commission to return to consumers unrefunded deposits aggregating $77,123 on hand at the time the city of Los Angeles took over the company's distribution system there. These deposits had been made to secure extensions. The city of Los Angeles contended that the money should be turned over to it, while the consumers, who were supported by the Edison company, claimed the refund.

Port of Seattle Year Book.—A handsomely printed and illustrated publication bearing this name has been issued under the authority of the municipality giving full data on Seattle's shipping business, terminal and harbor facilities, imports and exports and many other particulars of the rapidly growing city and port. Among the illustrations are one of the Gorge plant of the municipal Skagit River hydro-electric development and an outline map of the United States showing the water power of each state. This map bears the legend: "Total horsepower represented, 540,000,000, of which the State of Washington has one-sixth."

Interconnection in Southern Appalachian Region.—The general subject of interconnections between main and short lines and the contemplated super-power survey for the southern Appalachian mountain system were discussed at a meeting of the executives of the Southern Appalachian Water Power Conference held at Asheville, N. C., recently. The meeting was the first held since the formation of the conference last July. The entire proceedings of the conference are to be published in book form. If decision is reached to proceed with the survey, it

is probable that federal and state aid will be invoked. Prominent engineers of North Carolina, Georgia and Tennessee attended the conference.

Progress in Green Bay Region.—To increase the capacity and improve the light and power service in Marinette, Wis., and Menominee, Mich., a new 2,400-hp. waterwheel generator will be installed by the Wisconsin Public Service Corporation at its White Rapids power plant, 20 miles north of Marinette on the Menominee River. This installation will increase the capacity to 11,000 hp. Land has been purchased by the Menominee & Marinette Light & Traction Company for the purpose of erecting a new substation which will pool the Rapids hydro-electric plant with the High Falls and Johnson's Falls hydro-electric plants and the steam plants at Green Bay and Manitowoc, bringing a 40,000-hp. supply to the two cities.

Tennessee Electric Power Company to Have Headquarters in Chattanooga.—Announcement is made that the Tennessee Electric Power Company, recently formed as the result of the merger of several Tennessee utility companies, will have its headquarters at Chattanooga. The company, it is stated, has completed a survey of the probable power needs of the territory it serves and has found that the present plants are adequate to meet all demands for the next two years, but after that time, if contemplated developments in the industrial life of the section take place, the company will be forced to make additional provisions. The company has power sites on the upper Ocoee and other streams in the state, including the Tennessee River.

Progress on El Dorado Plant.—Rapid progress is being made on the 100,000-hp. hydro-electric development on the American River in California to be known as the El Dorado plant of the Western States Gas & Electric Company. About 1,500 men are engaged on construction work, and it is expected to have the first unit of 20,000 kw. completed by December, 1923. The ultimate development calls for four units totaling 100,000 hp. The operating head will be 1,900 ft., making this one of the high-head developments of the country. Work is now about 40 per cent complete on the first unit. A double-circuit 110,000-volt transmission line will be constructed to connect with the present system of the company, and this will later be extended to Stockton as the demand for energy increases.

Report of Toronto Hydro-Electric System.—The eleventh annual report of the Toronto Hydro-Electric System, for the year ended Dec. 31, 1921, has just been received. It indicates a gross income of $3,622,605, an expenditure for electrical energy, operation and maintenance of $2,212,374, and charges for interest, depreciation, taxes and similar items of $1,195,888, leaving a net surplus amounting to $214,353. Energy sold was 221,384,558 kw.-hr., the connected load was 227,600 hp. and the peak load 76,378 hp. There were 81,923 meters and 46,126 street lights in use. According to the report, "this year's figures show that to date the system's customers have been saved not less than approximately $28,000,000 of the aggregate they would have paid for the same amount of electrical energy had the rates that were in force in this city at the inception of the enterprise [1912] been continued."

Customer Ownership Analyzed.—In the current issue of the *Saturday Evening Post* (Nov. 11) James H. Collins presents an extensive analysis of the benefits of customer ownership of utility securities, basing most of his observations upon the customer-ownership development in the electric light and power industry. While much of the material presented by Mr. Collins will be new to electrical men, his interpretation of the advantages of customer ownership to the community and to the utilities is sure to prove of interest to the electrical fraternity.

Connecticut Light & Power Company's Devon Plant.—The new plant of the Connecticut Light & Power Company to be built at Devon, on the Housatonic River, as recorded by the *Electrical World* for Sept. 2, page 500, will start with the installation of two 25,000-kva. prime movers and is now being laid out to permit the ultimate addition of four 40,000-kw. units, though the size of the prime movers to be installed in the future has not been absolutely determined. The boiler pressure will be 300 lb. and the pressure at the throttle 285 lb. Westinghouse underfeed stokers and 1,680-hp. Springfield boilers are to be employed. The temperature of the steam will be 700 deg. at 300 per cent rating, and the closed system of ventilation will be used for the generators. This station, as already announced, will have a transmission system of 75 miles and will serve Waterbury, New Britain and the Naugatuck Valley directly and the western end of the state indirectly.

Indianapolis Competitive Situation Before Governor.—Whether the Indiana Public Service Commission shall permit the Terre Haute, Indianapolis & Eastern Traction Company to sell electrical energy to Indianapolis patrons is being considered by Governor McCray. The company recently petitioned for authority to provide service. The Merchants' Heat & Light Company and the Indianapolis Light & Heat Company, as possible competitors, are opposing the petition. Those who are trying to keep out the prospective competitor have argued before the Governor that if the traction company be permitted to enter the field it will be able to make a power service rate so low that the two companies now in the field will be unable to compete and will be left with residential lighting service as their principal business. The Indianapolis city administration is favorable to admitting the traction company, which is proposing to spend approximately $7,000,000 to enlarge its West Tenth Street and other city power stations.

Associations and Societies

Philadelphia Section, I. E. S.—Davis H. Tuck, illuminating engineer with the Holophane Company, New York, will address this section of the Illuminating Engineering Society on Tuesday evening, Nov. 14, his subject being "School Lighting."

Utah Contractor-Dealers Reorganize.—The Contractor-Dealers' Association of Utah has been reorganized and is now known as the Utah Association of Electragists. The following officers have been elected for the ensuing year: George R. Randall, president; G. W. Forsberg, vice-president; Blaine Gray, secretary; C. R. Dodge, treasurer. Noon luncheon meetings of the new association will be held on Tuesday of each week.

A. I. E. E. Sections Interested in Street Traction Problems.—The "trackless trolley" is to be discussed by J A. Queeney and J. F. Collins before the Philadelphia Section of the A.I.E.E. at its meeting on Monday, Nov. 13. The same subject was discussed at a recent meeting of the New York Section before a large gathering, when the relative merits of trolley cars, motor buses and the trackless conveyances were compared by J. C. Thirlwall of the General Electric Company's railway engineering department. The Baltimore Section has also discussed the topic.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-17. J. B. Walker, New York Transit Commission, New York.

Electrical Manufacturers' Club—Hot Springs, Va., Nov. 15-19.

Electrical Credit Association, Central Division—St. Louis, Nov. 16-17. F. P. Vose, 1347 Marquette Bldg., Chicago.

Electrical Supply Jobbers' Association—Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Physical Society—Chicago, Dec. 1 and 2. D. C. Miller, Case School of Applied Science, Cleveland.

American Society of Mechanical Engineers—New York, Dec. 4-8.

Electrical Supply Jobbers' Association, Pacific Coast Division—Coronado, Calif., Dec. 7-9. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

New York Electrical Credit Association—New York, Dec. 14. W. J. Kreger, 47 W. 34th St., New York.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Commission Rulings

Telephone Equipment for Radio Beyond Commission's Jurisdiction.—The Wisconsin Railroad Commission has dismissed the complaint of the Madison Kiwanis Club against the Wisconsin Telephone Company for its refusal to carry certain speeches to be broadcasted by wireless telephony, the commission asserting that it has no jurisdiction over telephone company equipment used in sending radio messages. An agreement between the club and the telephone company, however, permits the club to use the wires.

Company Forbidden to Require Customers to Advance Cost of Installing Meters.—Permission has been refused by the Illinois Commerce Commission to the Perry Light & Power Company to require the public to contribute to the capital expenditures of the utility by paying in advance the cost of installing meters, even though the amount so advanced is to be returned to the consumers by deductions from monthly bills. The charge complained against resulted from the discontinuance of the generating plant at Perry and the purchase of power from the Central Illinois Public Service Company, this necessitating the replacement of the former direct-current meters with alternating-current meters.

Pennsylvania Commission Orders 1906 Rates Restored.—The York Haven Water & Power Company has been directed by the Public Service Commission of Pennsylvania to restore its old rates for furnishing electric power to the borough of Middletown. The old rates were suspended by a tariff effective Oct. 1, 1920, which changed the charges to the borough from a flat rate of 1 cent per kilowatt-hour, as provided in a contract made in 1906, to a variable rate depending upon the amount of energy taken and monthly consumption. This change resulted in a virtual increase of about 50 per cent. The power company is now ordered to restore the old rates within ten days from the date of service, and they are to become effective on one day's notice.

Principles Governing Rural Rates.—In granting to the Mount Horeb Heat, Light & Power Company an increase in the rates charged farm customers ranging from $2 a month for a transformer rated at 1 kva. to $6.30 a month for a 7½-kva. transformer and from 14 cents for the first 20 kw.-hr. used per month to 5 cents for all in excess of 60 kw.-hr., the Wisconsin Railroad Commission made these observations: "The intent of a rural schedule is to provide a rural charge which will take care of all the excess fixed charges and operating expenses due to the nature of the rural business and which will, when paid, place the rural consumer on exactly the same basis as an equivalent urban consumer and make the urban rate applicable. In the present case applicant proposes to establish a block type of schedule together with a rural charge, instead of the active-load rate now in effect for urban service. This proposed schedule is designed to cover both lighting and power service. In its computations applicant has used certain figures which are at variance with those commonly used by the commission in computing the special fixed charges allocatable to rural service. It has, for example, used an allowance of 12 per cent to cover depreciation, taxes, maintenance, etc., whereas the commission has customarily used 10 per cent. No evidence has been submitted by applicant sufficient to cause the commission to revise its allowance in this case. In our computations, therefore, we have adhered to our usual allowance of 10 per cent."

Recent Court Decisions

State of Idaho Holds Title to Beds of Navigable Streams Below High-Water Mark.—Declaring, in Miller vs. Lewiston-Clarkston Canning Company, that in the State of Idaho the state holds title to the beds of navigable streams below the ordinary high-water mark for the use and benefit of the whole people, the Supreme Court of Idaho found that the appellants in the case had no right or title to any part of the bed of the Snake River. When land bordering upon navigable water is granted by a patent of the United States government, the court said, title to the adjacent land under the navigable water does not pass by virtue of the patent. It is the settled law of Idaho that title to such land is vested in the state. (209 Pac. 195.)*

Commission Cannot Force Resumption of Service Abandoned Because Federal Court Ordered Right-of-Way Vacated.—Twenty-one towns on the branch lines of the Louisville & Nashville Railroad in Alabama will not have their telegraph service restored and the State will be unable to collect penalties aggregating $914,000 against the Western Union Telegraph Company as a result of a decision of the Supreme Court of Alabama. The decision affirmed the decision of the circuit court of Montgomery County, which held that the telegraph company could not be forced to reinstate the service, which was abandoned when the federal court ordered it to vacate the right-of-way of the Louisville & Nashville Railroad. The Alabama Public Service Commission had ordered the telegraph company to continue the service when notice of abandonment was received. The telegraph company ignored the order, and the Attorney General of the state filed a petition to require the company to establish the service and to pay $1,000 for every day that passed without such re-establishment.

Municipality Has Right to Condemn State Lands for Public Use.—The city of Tacoma won a condemnation suit in connection with the development of the proposed Lake Cushman hydro-electric project when the Supreme Court at Olympia, Wash., reversing the court below, recently upheld the city's authority to condemn state lands for public use and to appropriate the entire flow of the north fork of the Skokomish River for hydro-electric purposes. The city showed that since 1901 the state had maintained a salmon-hatching station at the site, although the station had not been used since four months after it was built. There had been since that year no act or declaration of intention on the part of the state to use the station, and the mere fact that the state owns property and has the right and power to devote it to public use is not sufficient to estop the city, the court held, inasmuch as the city's proposed use is immediate and public. The court also found that the proposed diversion of the entire flow of the north fork of the stream would not be damaging to the state, but possibly be beneficial by preventing floods of the main stream at the Skokomish hatchery site.

Overhead Expense Paid from Revenues Should Not Necessarily Be Excluded in Valuation.—The Public Service Commission of New York erred, according to the finding of the New York Supreme Court, in People ex rel. New York State Railways vs. Commission, in excluding from the valuation of a utility overhead expenses representing necessary engineering, legal and administrative services in connection with the construction of utility property on the ground that they had been furnished by the regular staff of the company, whose salaries were charged to operating expenses. "Undoubtedly this feature should receive due consideration," said the commission, "but some portion of these expenses must necessarily have been incurred by reason of the organization, construction and development of the particular road in question." The commission disallowed nearly all the items, however, because "otherwise it would be necessary to revise the operating expense accounts by excluding a portion of the salaries of the officials concerned, and such revision would produce larger net earnings. . . . It has been held that past losses are not to be considered in determining the rate base and whether the present rate is confiscatory. It would seem to follow as a necessary corollary that if past losses may not be considered in fixing a base rate, neither should past profits be so considered, nor what would have been past profits or 'larger net earnings' by a readjustment of operating expenses." (195 N. Y. S. 174.)

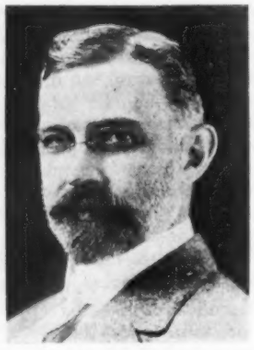
*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Doherty in Business Forty Years

Henry L. Doherty, who founded and built up the Cities Service Company, controlling more than a hundred public utility and petroleum subsidiaries, reaching from the Atlantic to the Pacific Coast and from Canada into Mexico, recently celebrated the fortieth anniversary of his entry into the public utility industry. "Doherty Week," Oct. 15 to Oct 23, was set aside as a mark of honor to their leader by the em-



H. L. DOHERTY

ployees of the Cities Service Oil Company and the Doherty organization. Mr. Doherty was a newsboy in Columbus, Ohio, when at the age of twelve he became an office boy with the Columbus Gas Company. As a result of hard work and close application he rose so rapidly in the engineering department that at twenty-two he was chief engineer and assistant to the manager of the Columbus plant. In that year he went to Madison, Wis., as manager of the Madison Gas & Electric Company, and later he became its president. Since then, in succession or simultaneously, he has filled the positions of engineer of the Columbus Electrical Company, general manager of the St. Paul Gas Light Company and St. Paul Edison Company, constructing engineer for the Jacques Cartier Electric Company of Quebec, chief engineer for Emerson McMillin & Company, New York, chief engineer and manager of the American Light & Traction Company, engineer and manager and afterward president of the Denver Gas & Electric Light Company. With this record to his credit, he developed his large public utility business, to which in more recent years he has added an oil business of great proportions.

Mr. Doherty has taken an active and most creditable part in many non-commercial bodies interested in the gas and electric industry. He guided the Society for Electrical Development from its beginning until a year or so ago, and during his term of office as president of the N. E. L. A. the program of the association was broadened to include commercial and accounting activities as well as engineering functions. Mr. Doherty is still working out new problems each day from his office at headquarters in New York, where he is applying the two principles that he adopted early in his career—"pride of workmanship" and "pride of service."

Philip S. Smith to Direct Geological Survey

The resignation of Dr. George Otis Smith as director of the United States Geological Survey, so that he could qualify legally as a member of the President's coal commission, places the full responsibility for the conduct of the survey during the next eleven months in the hands of Philip S. Smith, who has been serving as the survey's administrative geologist. The new director has spent practically his entire career on the staff of the survey. While his outstanding accomplishments have been based on his geological and economic studies in Alaska, he has had wide experience with many phases of the work done in his bureau. Dr. Smith's resignation is of a temporary character and he will be reappointed as director of the survey when his duties with the coal commission are over.

C. T. Russell General Counsel of New York Telephone Company

Charles T. Russell has been appointed general counsel of the New York Telephone Company, succeeding John L. Swayze, who died in August. Mr. Russell will have charge of all the legal, legislative and tax matters of the company and will also act as general counsel of the Empire City Subway Company, Ltd., the Friendship Telephone Company, the Holmes Electric Protective Company and the New York Telephone Realty Corporation. Mr. Russell became associated with the telephone company in 1906, when he accepted a position in the legal department. In 1911 he was appointed counsel and in 1915 general solicitor, in charge of all legal and tax questions other than legislative and Public Service Commmission matters.

Frank Rand is now chief engineer of the electric light and power plant at Titusville, Pa., replacing John Smith.

San Joaquin Utility Appoints G. S. Jacobs Consulting Engineer

Gaskell S. Jacobs, a prominent San Francisco engineer, has been appointed consulting engineer for the San Joaquin Light & Power Corporation and subsidiary companies, with headquarters in Fresno. Mr. Jacobs enters this work after thirteen years of public utility work with various California companies and a long experience on the staff of the California Railroad Commission and in independent consulting work. After graduation from the University of California in 1909 he was engaged as engineer on the staff of the People's Water Company of Oakland, now known as the East Bay Water Company. In 1911 he was engaged by the J. G. White Engineering Corporation for valuation work, with headquar-

G. S. JACOBS

ters in San Francisco. After spending the following year with the Great Western Power Company in its Northwestern division he became associated with C. L. Cory of Berkeley in rate and valuation work. Later he was engaged in special work for the Pacific Gas & Electric Company, and from 1915 to 1921 he was on the staff of the California Railroad Commission in the gas and electric department. For more than a year past Mr. Jacobs has been associated with F. Emerson Hoar in special investigations in rate valuations and project developments in San Francisco. His many years of experience well qualify him for his new work with the San Joaquin Light & Power Corporation in helping to co-ordinate its extensive operations.

John H. Anderton, of the firm of Thebo, Starr & Anderton, consulting engineers of San Francisco, has recently returned from Japan, where he spent several years in supervising hydro-electric development on the Kisogawa River in the heart of the Japanese Alps for the Daido Electric Company. Mr. Anderton was formerly chief engineer for the Stone & Webster interests.

O. R. Hogue New Walker Sales Manager

Oliver R. Hogue, chairman of the Commercial Section, N. E. L. A., on Nov. 1 assumed the position of sales manager for the Walker Vehicle Company, Chicago. To this position he brings the training and experience obtained during twenty-five years' active service in the electrical industry. Mr. Hogue was born in Philadelphia in 1874, going to Chicago with his parents the same year. In 1896 he became associated with the Chicago Edison Company, now the Commonwealth Edison Company, and he has served this company ever since as chief clerk in both the inspection and contract departments and later, up to the time of his new connection, as head lighting agent. He has been a consistent worker in the

O. R. HOGUE

lighting end of the central-station business, having organized an engineering corps for the purpose of furnishing customers with reliable data on layouts for lighting systems. As chairman of the Lighting Sales Bureau in 1921 he was largely instrumental in obtaining information on store lighting. He has taken a prominent part in the activities of the N. E. L. A., the I. E. S. and the Illinois State Electric Association.

J. C. Hoyt, administrative official of the division of surface waters of the Geological Survey, Washington, D. C., has just returned after a six weeks' tour of Western districts.

Elwin M. Inghram has been appointed to the position of engineer in charge of stations No. 7 and No. 8 of the Public Service Company of Northern Illinois at Joliet, replacing D. C. Fraser, who was made master mechanic some time ago. Mr. Inghram went into the service of the Economy Light & Power Company in 1907, and when it was absorbed by the Public Service Company became an employee of the latter. Before his present promotion he was assistant to the engineer of stations No. 7 and No. 8.

George P. Rich is now chief engineer of the Walhalla Electric Power Plant, Walhalla, N. D., replacing V. C. Kelsey.

L. D. Cornell is now superintendent of the Ipswich Electric Light & Power Company, Ipswich, S. D., replacing W. H. Morris.

C. P. Frey is now engineer in charge of the power station of the municipal water and electric light plant at Springfield, Tenn., replacing W. L. Felts.

Samuel Ferguson, vice-president of the Hartford (Conn.) Electric Light Company, has been elected second vice-president of the Hartford Chamber of Commerce.

C. Opitz, formerly district agent for the Puget Sound Power & Light Company at Renton, Wash., has resigned to become district agent for the Olympic Power Company at Port Angeles, Wash. L. P. Heath has been appointed to the vacancy at Renton.

L. M. Kean, for six years connected with the sales department of the Edison Electric Appliance Company, has joined the Faden Electric Company, Chicago. This appointment dates from Oct. 1, when the Faden company became a distributor of Hotpoint products.

Frederick Franz, who for the past four years was chief engineer of the Terminal Engineering Company, has established an engineering office in New York City for the purpose of solving special problems of engineering relating to labor-saving machinery for industrial plants.

A. L. Thexton has been made assistant editor of the *Edison Round Table*, the semi-monthly publication issued by the Edison Club for the employees of the Commonwealth Edison Company. He is succeeding M. J. Lucas, who has become associated with the advertising department of the company. Mr. Thexton brings many years of newspaper experience to the service of the organization.

Howard D. Matthews has terminated his connection with the Milwaukee School of Engineering, where he has been head of the department of electrical design for the last four years, and is now in the engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. Before going to Milwaukee Mr. Matthews was for ten years with the General Electric Company at Schenectady, N. Y., as a designing engineer.

Frederick B. Larsen has become associated as field representative for South Carolina, Georgia and Florida with the Bryant Electric Company of Bridgeport, Conn. For three years he has been manager of the Hunter Electric Company of Clearwater, Fla., and prior to 1919 he was for twelve years a sales representative of the Robbins & Myers Company in the South Atlantic States. Mr. Larsen brings to his new duties not only a wide acquaintance with business in the South but experience as a contractor-dealer.

Westinghouse Chief Engineer Honored

In recognition of his notable engineering achievements as chief engineer of the Westinghouse Electric & Manufacturing Company, the Joseph Sullivant medal has been awarded to Benjamin G. Lamme by the Ohio State University. This medal owes its establishment to Dr. Thomas C. Mendenhall, professor emeritus of physics and a member of the board of trustees, who recently presented the university with a fund for that purpose in honor of Joseph Sullivant, a member of the first board of trustees and a man more influential than any other person in determining the character and future of the university at the most critical period in its history. Mr. Lamme, who was graduated from Ohio State in 1888

B. G. LAMME

in mechanical engineering, is the first person to receive the medal. He has been associated with the Westinghouse Electric & Manufacturing Company since 1889 and has been its chief engineer for nineteen years, having become one of the best known electrical engineers not only in the United States but also throughout the world. About four years ago he was elected chairman of the Naval Consulting Board, and in June, 1919, the Edison medal was awarded to him by the American Institute of Electrical Engineers for special merit in engineering and research.

Charles E. Stahl, vice-president, assistant general manager and sales manager of the Connecticut Telephone & Electric Company, Meriden, Conn., has resigned. Mr. Stahl had been with the company for ten years.

William A. Root, formerly assistant secretary of the Bronx Gas & Electric Company of New York City, is now the treasurer of the company, with which he became associated ten years ago as new-business manager. Previous to his connection with this company Mr. Root was purchasing agent of the Empire Gas & Electric Company with headquarters at Auburn, N. Y.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Quality in Product and in Salesmanship*

Influence of Creative Standardization on Competition—Education of the Salesman in Essential Policies

By R. J. Russell

President Electric Power Club, Vice-president and Secretary Century Electric Company, St. Louis

COMPETITION among manufacturers is possible only because all are competing to preserve the quality of their wares of service. Without competition, development and expansion are slow and unusual. Our very existence makes it necessary that we seek ways to preserve our quality. The best survivor is he who is the best co-operator. He who has not developed qualities fit to survive and function with others is weak and cannot successfully co-operate. We can co-operate with and help each other by setting up standards of minimum quality for the guidance of others, and all this without action which essentially obstructs the activities of any one.

Two Ways to Compete

I believe that without exception all electrical manufacturers have competition — both at home and abroad. There are only two ways to meet it:

(a) The negative way, which is to reduce the quality of the article and sell it on price.

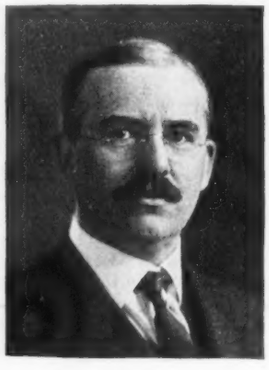
No manufacturer of electrical apparatus can succeed who turns out goods of poor grade, due to design, to material, to workmanship or to all three, because the demand is not great enough to permit him to avoid the selling effort, and the sales effort required by low-quality goods will prove entirely too expensive because of the small number of repeat orders.

(b) The other or positive way, which is to keep up the quality—one of the definite objects of the Electric Power Club.

It is most important to make the price fair, reduce overheads to reduce costs, employ acknowledged good business practices and build up a good sales organization to market the product, and keep everlastingly at the job of manufacturing and selling.

That we certainly cannot expect to compete in the overseas market on any other than a quality basis all who are active in the foreign field must be ready to agree; hence we must as Americans co-operate to keep up the quality and advance the reputation of our products and to maintain clean-cut businesslike policies and practices abroad.

As we decide upon standards which indicate our belief of the minimum of quality the industry should offer, we should further co-operate to obtain the best results for all interested by incorporating these standards in our daily practice—to compete on the basis of superior quality or service within reasonable limits. To do this without the lapse of an appreciable period of time is not always easy for various reasons:



R. J. RUSSELL

(a) We may be delayed because of necessity for working off several months' supply of a given line or size of goods or parts therefor.

(b) We may not feel sufficiently strong commercially to undertake the pioneer work of launching a new line or practice ahead of our larger and better equipped competitors.

(c) We may not find ourselves financially able to make immediately the investment necessary to put the new standards into practice.

But delays in adoption of new standards should be avoided—they suggest to the uninformed public, other associations and engineering bodies many things that are not particularly desirable. When standards are adopted, we should individually let the public know it, and state it in our advertisements, our literature, our price sheets and even on our nameplate. By all means we should refrain from offering freak ratings or adopting peculiar or questionable practices which as a body we may soon find it difficult to correct.

Reduction of Overheads Important

One of the best ways to compete profitably is to decrease the overhead. The question of reducing overhead or burden is one that I hesitate to start to discuss because it is such a broad one. I firmly believe there are but few factories that cannot by careful thought be relieved of some of the burden. In some of them we find too broad or varied a line of goods manufactured or not enough to get good production from a small line. In other words, they are job shops as compared to a shop that has tools at work on one operation for days at a time if not continuously. And then in others there are too many non-producers—for instance, engineers—who cannot let a design rest long enough to get it into real production. In many cases we need to give more attention to the small affairs of our business.

The question of what price to charge for the product of our works is something that should have our most careful consideration before it is established. He who allows his competitors, in lines like ours, to fix his price is in serious danger. His competitor may be guessing or have made a mistake in his calculation. The Electric Power Club has co-operated with the rest of the electrical manufacturing industry in setting up a most creditable account-

*Abstract of presidential address before Electric Power Club, Asheville, N. C., Oct. 30-Nov. 2, 1922.

ing system. If we use it or its equivalent and take the results as our guide to what we can do under normal conditions and apply a factor of safety to cover the lean years or periods, our price will not be such as to prevent people buying and filling up our works.

Competition is especially keen in business practices. It is keen particularly because many continually endeavor to go their competitors just one better in terms, conditions of sale and so on. We find that those who compete most successfully, who co-operate best, are they who have established a definite policy governing all phases of their business. Using as their guide a determination to treat all alike and to conduct the business along what are generally conceded to be safe and sane lines, they have put this policy into such definite rules that their individual organization understands it and carries it out. Usually their policy will incorporate a margin of safety into the articles they make, so that their value will not be less than the customer has knowingly purchased and make it necessary to answer complaints and make replacements or repairs.

When manufacturers establish this principle their terms or financial practices are not such as encroach upon the field of the banker through the indorsing of customers' paper. Their stock remains in or under their control where it can be used to satisfy any customer who places an order. Those who believe that placing consigned stock with prospective customers is profitable should examine each case carefully as some surprises may await them.

High-Class Salesmen Necessary

Competition of a high order can be indulged in when we have sales organizations made up of men who are a credit to the industry and reflect the personality of the house they represent and carry out its precepts with authority. We, in the industry represented by the Electric Power Club, do not obtain our best salesmen from among those who are suspected of being "natural-born electricians," neither do we secure them from our competitors. We must make them—and that takes time.

The best are made by selecting them carefully from among technically trained men—men who know how to find out, who have had little, if any, of the varied experience such men frequently desire to acquire. We must look well to their nationality, age, stature, appearance, health, reputation, habits and so forth. We can take into our employ men like these who have not acquired fixed habits and practices in the business world, and in a few months—

(a) Teach them that they must be guided by the highest code of ethics they can conceive.

(b) Teach them that they and the company they are connected with cannot have all of the business to be had unless perchance they have a monopoly on their line.

(c) Teach them the fundamentals of our policy.

(d) Convince them as to which is the best kind of business to seek—for illustration, motors off the shelf, because then the works can be operated more economically through an even rate of production and steady employment of workmen.

(e) Teach them that in handling complaints they must never assume the burden of proof, but rather maintain that the apparatus is right until it is proved otherwise or its condition indicates an inherent defect.

(f) Teach them that every transaction involving a portion of the productive capacity of the factory must be covered by a non-cancellable order or contract—that we cannot otherwise insure the sale of that capacity.

(g) And, finally, put the salesman on a salary with no commission and remove the temptation to work for the customer.

Finally, let us learn to know our competitors better that we may be able to co-operate more efficiently. It will aid our efforts to reach decisions as rapidly as possible on the various questions of standardization that have for their object an improvement in the articles we manufacture. It will improve the standing of our product and the demand for it not only in this country but abroad.

And to this end let us assume a co-operative attitude toward other organizations that are carrying on co-operative work, even though they may be concerned with matters in which we may have only passing interest.

Will the Electrical Jobber Endure?

How This Question Finds a Practical Answer in the Record of the Hardware Industry—What the Jobber's Function Should Be—With a Word on Compensation

By W. E. Robertson
General Manager Robertson Cataract Electric Company, Buffalo, N. Y.

IT ALWAYS amuses me when I hear men hold forth on the future of the jobbing business in the electrical industry and predict that the wholesaler is on his way to oblivion. They strive to prove that the jobber was an economic necessity during a certain period of our development, but that with the increasing activity of the larger manufacturers and their more broadly organized selling distributing machinery in certain lines the jobber is ceasing to serve any useful purpose. And they are apt to cite the dwindling of the dry-goods jobber as ominous evidence.

It so happens that I had occasion not long ago to investigate the record of the jobber in the only line directly comparable with ours—the hardware jobber. The dry-goods jobber is not comparable. He sold the output of mills manufacturing varied and kindred designs and styles in a staple line, changing little fundamentally from year to year, and the evolution of the great department stores bridged over his head. But the hardware line embraces a broad variety of staples and specialties constantly changing and progressing, ever in a state of flux. And as the world moves on the hardware jobber changes with it, steadily gathering this assorted merchandise, combining it and making it available to the retailer to enable him to meet the onward drifting demand of the public. He serves the same economic purpose that the electrical jobber does.

Why Jobbers Live Long

I applied to Babson and to the Harvard Research Bureau for statistics on the stability of the jobbing business. They had no data, but I pursued my own investigation and found out some interesting things. I found, for instance, that in New York there are two such jobbing

houses that antedate the Constitution of the United States. In Philadelphia there is a hardware jobber that dates back to four years after the coming of William Penn. And there is one in Buffalo that was established there shortly after the British burned the city. And the reason why the hardware jobber endures so long, I believe, is this:

The manufacturer in any industry produces a limited line. His market and his prosperity are affected by all manner of localized influences. Along comes an industrial crisis and he fails. New inventions come along and take his market away from him. Some unexpected obstacle interferes with his service of supply. Styles or other trends in his field change the whole nature of his opportunity. But the jobber has a broader line. His eggs are not all in one basket. When the times change his line changes in balance with the altered market. He buys in the markets of the world and he sells not a line but a trade, and his problem is not the restricted necessity for selling that which he makes but rather the need for providing whatever his trade wants at the time.

Manufacturers may change, markets may change, the character of the demand may change, good times may come and go, and even governments may change, but the jobber goes ahead meeting the demand that is to be met and continuing to function in tune with the times. I can see no possible reason for any uncertainty as to the permanence of the electrical jobbing business when I contemplate the history of the hardware jobber.

It is well, however, to remember one thing. There never has been and never will be opportunity for spectacular profit in this business. The very elements that make for its durability preclude this possibility. Success through succeeding generations rests fundamentally upon an intelligent understanding of the present and proximate future needs of the territory served, a knowledge of the world centers where these needed things are produced and of the transportation, customs and other charges that must be added in obtaining them. These are the things that will determine the compensation to be derived therefrom:

1. Low cost of warehousing.
2. An appreciation of the significance of turnover.
3. Accurate cost accounting without indulgence in frills.
4. A strong selling force of steady pluggers.
5. The establishment of a reputation for dependability that must be maintained at all costs.
6. Constant and careful training of men in the policies and traditions of the business, so they may take the places of the older men as their work is finished.
7. The accumulation of reserves out of profit to care for periods of depressions, which are inevitable and which no cleverness can prevent or altogether overcome.
8. And, finally, first, last and all the time, the quality and need of the service rendered.

The reason that I have stayed in the electrical jobbing business and the reason that it sustains my interest year after year is because it presents this ever-changing panorama of opportunity. No man who is striving to make his organization function as it should can ever go stale. Within our easy recollection we have passed through the tremendously interesting experiences of radio, of the electric clothes washer, of the electric vacuum cleaner and a dozen more striking examples. We have seen each one of these lines come groping into the light, gain strength and grow into a boom and then settle down into a business. All the more reasons why we, each one of us, should study carefully every new line that comes along before embarking on its exploitation and its distribution.

WHAT THE FUNCTION SHOULD BE

Before the jobber takes on a line he should determine and know fully what he is to do with it. If the manufacturer is to create the demand, then the jobber should be paid for the warehousing function. But if the manufacturer is going to rely on the jobber to do the pioneering and create the market, then the jobber must be adequately compensated for this greater responsibility and the greater effort entailed. There have been many cases where the manufacturer has convinced the jobber that he should do the market building in order to enjoy the benefits of the expected future reorder business and then the manufacturer has changed his policy or his line and no future profit has come. And so the jobber should study always what part it is that he should play in the distribution of any commodity, not just to fit into the plan of the manufacturer but to suit the future demands of the market. His profit on that line should be arranged in accordance therewith. And the jobber should concentrate his attention and his effort on the line that pays.

No man need feel any lack of confidence in the future of the electrical jobber. For the jobber renders an absolutely essential service to the industry as the great balance wheel of distribution. He provides a permanence and stability to the electrical trade that is of a value beyond estimation. And as the hardware jobber has endured through all these generations so will the electrical jobber bend to the times and "carry on" through each succeeding stage of evolution.

Survey of Business Conditions

Appliance Manufacturers Enjoying Better Business

Manufacturers of electrical socket devices for home and other use are as a rule much busier than last year. Production is still going forward on orders placed in anticipation of the 1922 holiday trade and plans are being made for next year's business. An excellent Christmas demand is anticipated this year. At present in some quarters there is much difficulty reported in securing a suitable labor supply.

Sales of appliances to South Africa, Australia and South America are improving. Toasters, flat-irons, waffle irons, radiant heaters and other lighter devices are selling best in this country. Interest in electric ranges is reasonably active, although the present is a quiet period of the year in this line.

October sales for wedding presents showed up well in the hollow-ware lines, and a gain in interest in vacuum cleaners is beginning to be in evidence. Prices hold firm in appliance lines, and the volume of trade is responsive to the efforts of central-station companies and other retailers to develop new business.

Greatest Bituminous Loadings Recorded Last Week

The railroads of the United States loaded more bituminous coal during the first three days of last week than during any corresponding period since the miners' strike began on April 1 last, according to reports received from the carriers by the American Railway Association.

The total for the three days was 105,571 cars. This exceeded by 1,598 cars the total for the same three days of the previous week, which had marked the peak for such a period.

Bituminous coal loading on Wednes-

day of last week amounted to 28,048 cars, while loading of anthracite coal on the same day totaled 1,931 cars. Both were reductions under the day before and which were due to the observance in the coal fields of All Souls' Day on Nov. 1.

Storage-Battery Business for Renewals Is Most Active

In its November *Monthly Business Review* the Federal Reserve Bank of Cleveland says that a well-known storage-battery company in that district sold more batteries in the month of September for renewal purposes than it ever sold in one month before. Commenting on conditions in the industry, the review says:

"The storage-battery business is reported to be very good with most of the large companies. Orders from car manufacturers for original equipment are holding up well and are in keeping with the time of the year. During the period when prices showed frequent drops dealers were inclined to carry small stocks, but this condition has changed now and the manufacturers believe dealers' stocks are normal.

"The electrical industry is reported to be keeping in step with the general improvement in business. The direction in which this business is showing the greatest improvement is in the additional equipment ordered by public utility corporations to take care of the rapidly growing demand for electricity in all its uses. This demand is not confined to any particular locality, but it is remarkably widespread over the entire length and breadth of our country. A demand for generating and transforming apparatus, together with switching and control apparatus, is reported by a large company to be coming from central stations in all parts of the United States.

September Electrical Exports Totaled Over $5,000,000

Electrical machinery, apparatus and appurtenances to the extent of more than $5,000,000 were exported during September, returns to the Deartment of Commerce show. The detailed figures are as follows:

ELECTRICAL EXPORTS FOR SEPTEMBER, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	September, 1921	September, 1922
	Value	
Turbines	.....	$68,574
Generators	$855,419	.....
Direct-current		
Under 500 kw	.....	57,467
500 kw. and over	.....	104,222
Alternating current		
Under 2,000 kw	.....	7,688
2,000 kw. and over	.....	24,870
Accessories and parts for generators	.....	30,680
Self-contained lighting outfits	.....	48,339
Batteries	271,232	.....
Primary—dry	.....	88,441
Primary—wet	.....	111
Storage	.....	142,387
Transforming and converting apparatus:		
Transformers	353,033	.....
Power transformers	.....	499,755
Other transformers	.....	80,390
Rectifiers	.....	5,359
Condensers, double-current and motor generators, dynamotors, synchronous and other converters	.....	113,834
Transmission and distributing apparatus:		
Switches and accessories	159,690	.....
Switches and panel boards, except telephones	.....	365,348
Switches and circuit breakers	.....	131,359
Fuses and fuse plugs	.....	15,612
Meters and measuring instruments	191,411	.....
Watt-hour and other measuring instruments	.....	24,270
Volt, watt and ampere meters and other recording, indicating and testing apparatus	.....	66,915
Lightning arresters, choke coil reactors and other protective devices	.....	66,567
Motors, starters and controllers:		
Motors under 1 hp	.....	78,829
Stationary motors—		
1 to 200 hp	.....	188,390
Over 200 hp	.....	25,320
Railway motors	75,307	35,251
Electric locomotives	59,817	.....
Railway	.....	132,498
Mining and industrial	.....	28,297
Other motors	537,558	12,847
Rheostats, controllers and other starting and controlling equipment	45,304	106,414
Accessories and parts of motors	.....	112,015
Electrical Appliances:		
Electric fans	$21,129	$59,537
Electric lamps—		
Arc	455	2,288
Incandescent—		
Carbon-filament	2,448	7,019
Metal-filament	76,187	99,893
Other electric lamps	.....	17,505
Flashlights	.....	29,630
Searchlights and projectors	.....	22,247
Motor-driven household devices	.....	49,920
Domestic heating and cooking apparatus	95,699	56,748
Industrial electric furnaces and ovens	.....	24,988
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries	.....	46,716
Signal and communication devices:		
Radio and wireless apparatus	65,563	207,535
Telegraph apparatus	.....	34,261
Telephone apparatus, including switchboards	262,062	296,025
Police, fire and burglar alarm apparatus	.....	4,577
Railway signals, switches and appurtenances	.....	25,469
Bells, buzzers and annunciators	.....	7,162
Other electrical apparatus:		
Spark plugs, magnetos and other ignition apparatus	66,509	96,984
Insulating material	.....	90,048
Metal conduit, outlet and switchboxes	.....	23,434
Sockets, outlets and receptacles	.....	65,735
Other wiring devices	55,761	158,818
Other electrical apparatus, not elsewhere specified	1,544,876	417,394
Globes and shades for lighting fixtures	.....	37,495
Electric glassware—except for lighting	.....	18,278
Electric porcelain	.....	129,241
Carbons for electric lighting, electrodes and batteries	42,402	109,724
Insulated wire and cables (iron and steel)	.....	25,403
Manufactures of aluminum, including wire	193,648	63,411
Copper:		
Bare wire	65,787	161,493
Insulated wire and cable	270,145	187,544
Total electrical machinery apparatus and appurtenances	$5,311,442	$5,238,753

Electrical Heating Appliance Sales Increasing in England

Considerable publicity is being given by British electricity supply interests to the use of appliances for heating and cooking, with some noteworthy results. A striking example is at the plant at Croydon, where the heating and cooking load has been increased from 68,727 to 768,240 units in the past year

Says Average American Home Offers Big Lighting Market

That the average American home offers one of the largest lighting markets, and that the average total wattage per home is less than half what it should be to provide adequate and proper lighting, is the opinion of M. Luckiesh, director of applied science, National Lamp Works of the General Electric Company. Mr. Luckiesh has presented the situation in the following manner:

"Investigation of nearly 2,000 homes in more than twenty representative cities throughout the country shows that the watts per socket is fairly close to the recommended average. The deficiency lies in the number of sockets per home. Particularly is the scarcity felt in the case of convenience outlets, portable lamps and wall brackets.

"Some idea of the wonderful opportunity that awaits the progressive dealer for the sale of electrical conveniences can be seen from the following table, in which is shown what a small portion of the potential market for your goods has been reached. A few introductory words are first necessary to show how the figures were derived.

"We have 'built' or set up in our mind's eye an average home, conservatively lighted, of middle-class family, which we say consists of six rooms besides bathroom, basement, hallways, porches, etc. In this home we assumed there are nine convenience outlets, eight portable lamps, nine wall brackets, six ceiling fixtures and lamps aggregating 1,770 watts. When compared with the standard of lighting and electrical convenience that guides the building of present-day 'electrical homes,' you will readily agree that we have been conservative in our 'conservative ideal home.'

PRESENT BUSINESS IN TERMS OF WHAT IT SHOULD BE

	Percentage	
	Saturation of Present Market (8,000,000 Wired Homes)	Saturation of Potential Market (All Wired and Unwired Homes)
Wattage of lamps	46	15
Energy consumption (estimated)	50	17
Convenience outlets	28	9
Portable lamps	20	7
Wall brackets	29	10
Ceiling fixtures	100	33
Modern ceiling luminaires (estimated)	50	17

"The second point to bear in mind is that only about 8,000,000 homes, or about one-third of the total homes in this country, are wired for electric service."

The Metal Market

Difference of Opinion as to Price of Copper at 13⅞ Cents—Steel Is Slow

There is more difference of opinion as to the price of copper this week than of any of the other metals. Several producers are holding to the 13⅞ cents delivered level and have sold several thousand tons at that price, even where the freight rate is slightly less than normal in some instances. The 13⅞-cent business has been greater than last week, and one producer reports that the 13.75-cent copper seems to have been pretty well cleaned up. The larger consumers around New York also report no difficulty in getting copper at the lower price.

Most of the metal sold has been for November-December-January delivery, though there is no quotable difference in the price of copper for November shipment from that for shipment in the first quarter of the new year.

Consumption continues excellent, but there are indications that consumers are fairly well supplied with copper for the remainder of the year and that the demand from now on will be largely confined to first-quarter shipment or delivery.

Export business has been about on the scale of last week at prices at or slightly below 14 cents, c.i.f. A feature of the export market has been the ratification of agreements between the Nichols Copper Company and certain foreign interests whereby the Nichols company will actively compete for business in the foreign market. This competition with the Copper Export Association and other selling interests has already been evident.

The irregularities recently developed in iron and steel, in respect of both demand and prices, continue in evidence. Apart from railroad requirements, which remain a prominent feature, buying of iron and steel has abated, and premiums on deliveries are disappearing.

NEW YORK METAL MARKET PRICES

	Nov. 2, 1922 Cents per Pound	Nov. 9, 1922 Cents per Pound
Copper		
Prime Lake	13.87½	13.87½
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light	5.25– 5.50	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	3.00– 3.37½	3.00– 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

CONDITIONS in the electrical industry continue to improve. Jobbers and manufacturers announce better business than for some weeks past and are satisfied with the outlook for future orders. Central-station business shows improvement. Fixtures for commercial use are selling better, and there is less effort shown in placing outside business. Conduit stocks are spotty, but jobbers are finding it less difficult to fill reasonably large orders. Heater sales are better along the Pacific Coast owing to colder weather.

New York

Spotty Conduit Stocks in Evidence—Heating Devices in Demand—Fixtures Selling Well

Business continues to improve in all lines and there is much optimism expressed concerning its prospects. Deliveries are better. Prices generally are firm.

Conduit.—Spotty stocks are in evidence, but now and then jobbers are filling reasonably large orders. Prices are firm.

Appliances.—Heating devices for lamp-socket service are in much better demand, toasters and percolators being especially sought. Some increase in heater selling is noted. Washers and vacuum cleaners are moving fairly well and are being sold under intense competition.

Fixtures.—An increase in buying is apparent. Many jobs long postponed are now coming into the market. Commercial installations are absorbing much material, and less outside campaigning is needed.

Chicago

Wire Demand Steady—Conduit Still Scarce—Motor Sales Active—Radio Call Slow

Business in the electrical trade for the past week has been steady but uneventful. Prices on wire and conduit are firm, and the demand for conduit still remains above the supply. Manufacturers of high-tension equipment still report active business. Motor sales for the month have been brisk.

Conduit.—Shipments from manufacturers arrive just often enough to tease jobbers into believing that the conduit situation may soon be improved.

Wire.—The market continues steady and prices are firm. Rubber-covered No. 14 is available for $6.40 per 1,000 ft. in lots of 5,000 ft. Stocks are normal. Call for weatherproof or bare wire has been featureless although prices are steady.

Flexible Armored Conductor.—No change in price. The No. 14 two-wire single-strip still remains at $45 per 1,000 ft. in 5,000-ft. lots.

High-Tension Equipment.—Sales remain active. Orders for the following were received by one company: Six 33,000-volt steel-tower outdoor substations ranging in capacity from 300 kw. to 900 kw.; four 66,000-volt substations with capacities from 1,200 kw. to 3,000 kw.; thirteen 13,200-volt substations ranging from 200 kw. to 600 kw. Another firm shipped some 70,000-volt switching gear equipment to a utility in Pennsylvania.

Motors.—Movement on the smaller sizes is brisk, but while prices have not been advanced the tendency is upward. Most of this equipment is installed for new power requirements. Stocks of dealers and manufacturers are good. Most manufacturers report their sales curve has advanced for the past month.

Radio.—Several indications toward the start of the fall radio boom have not developed. The buying public has shown only slight interest in this equipment. Dealers' shelves are well provided with complete sets, head telephones, vacuum tubes and spare parts.

Boston

Loom Prices Showing Tendency to Stiffen—Flexible Armored Conductor Deliveries Well Maintained

Trade continues in well-sustained volume, with a more favorable delivery situation for the time being. Prices are firm, with upward tendencies in loom. Jobbers are doing a much better business than for many months. General business is improving in New England. The woolen industry is very active, and building contracts for the week ended Oct. 31 totaled $8,361,400 against $3,779,100 for the same week last year. Conditions in the leather manufacturing field are improved, paper mills are busy and electrical machinery is in broader demand. Retail trade is much better this fall than last year. Metal-manufacturing plants are showing decided improvement and some labor scarcity is noted.

Wire.—Rubber-covered No. 14 sells at $6.25 per 1,000 ft. in 1,000-ft. lots, with an active market and ample supply. Weatherproof, on a 17.5-cent base, is moving fairly well according to central-station expansion needs. The bare-wire market is dull, the tendency toward the use of loops and vacuum-tube radio sets cutting down the sale of copper conductors for outside aerial construction.

Loom.—Prices are showing a tend-

ency to stiffen slightly on account of the upward movement of cotton costs. Only moderate sales of loom are reported.

Motors.—Previous gains in motor sales are being held, and a gradual month-to-month improvement in business is noted on sales sheets. Lately some large motors, of 100 hp. rating and over, have been purchased for paper-mill work. A wholesome demand exists for small motors of integral horsepower ratings, and just at present interest is quickening in fractional-horsepower motors. Sales of these last are relatively higher than of other ranges. Prices are firm and steady, deliveries being easy and generally from factory or distributors' stocks.

Flexible Armored Conductor.—Orders are in good volume, and deliveries are well maintained. No. 14 single-strip is steady at $44.20 per 1,000 ft. in 1,000-ft. lots.

Atlanta

Conduit Shortage Reported — Industrial Motors Slow—Good Stocks of Porcelain on Hand

"Business conditions are unmistakably better than they have been for any time in more than two years," according to the business summary of the Sixth Federal Reserve Bank. Retail trade was larger in the aggregate for September than for the same month last year, this being the first increase shown over a corresponding period of a year ago. Business is booming throughout the district with an enormous amount of construction under way, and the prospects are for this rate being maintained until well in the spring. Electrical business is brisk. A shortage in conduit is reported, with an advance of two points effective this week.

Industrial Motors.—Demand continues rather slow, though prospects for improvement are to be noted. Stocks are in good shape, with shipments and deliveries satisfactory.

Armored Conductor.—Extensive building construction is stimulating sales in this line and the volume of orders is good. Jobbers' stocks have been brought up to standard with deliveries satisfactory. Prices remain steady.

Porcelain.—Good stocks are on hand throughout the territory with sales quite active in all varieties. Shipments are satisfactory, with no recent price changes reported.

Schedule Material. — Keeping pace with building materials in general. Ample stocks are the rule throughout the territory, with prices remaining steady.

High-Tension Transformers.—High-tension transformers have slowed down with no immediate prospects for a pick-up until spring. There are practically no stocks on hand, and shipments are varying from a matter of six to twenty-four weeks.

St. Louis

Power-Equipment Business More Active—Shortage of Higher-Voltage-Type Lightning Arresters

Building permits in St. Louis jumped from $1,715,117 in September to $2,957,283 in October. The principal items of increase were hospitals and schools, the October permits containing an item of $150,000 for a hospital and another of $1,148,000 for a school building. Residential and industrial construction continues on about the same level as for several months past. The industrial permits for October amounted to $95,700, but this does not include cost of equipment.

Power-equipment business is becoming quite active as evidenced by heavier motor sales. Central stations are closing large blocks of power contracts. two in excess of 1,500 kw. each being reported as closed last week. These two represent replacement of isolated plants and will result in large orders for motors, transformers, converters and similar equipment. Construction work has just started on a new factory for the Atlas Tack Company which will require about 500 hp. in motors and about 100 kw. in industrial heating equipment.

Lightning Arresters.—Sales are very good in all types from 13,200 volts down. Local stocks are short on the higher voltage, but ample for 2,300 volts and lower. Several good orders for 2,300-volt arresters were placed last week. Prices are unchanged but keenly competitive.

Meters.—Central stations are reasonably well stocked and there are no striking developments in sales. Local stocks are in excellent condition. Prices show no indication of immediate change. Portable meter business is quite dull.

Motors.—Fractional-horsepower business is exceedingly competitive, with demand fair and slowly improving. Industrial sizes, especially from 3 hp. to 25 hp., are active. Stocks are good but reasonably conservative. Recent price adjustments have been made which slightly increase the level.

Cleveland

Jobbers and Dealers Taking Advantage of Milder Weather to Replenish Heater Stocks

Appliances dominated the week. Lighting fixtures have had fair demand and washers and ironers have been active. Jobbers report good collections.

Radio.—Dealers are moving out parts rapidly. The renewal of activity has brought a number of small orders to jobbers for holiday delivery.

Heaters.—Jobbers and dealers have taken advantage of the milder weather to replenish their stocks. The small portable type continues to have fair demand.

Washers and Ironers.—All standard makes are in good demand with sales of ironers better. Jobbers have sufficient orders on hand to insure activity until after the holidays, while manufacturers report production easily absorbed.

Ranges.—It is thought that the recent exhibitions of electrical homes are responsible for the increased demand for ranges. Stocks of ranges on hand are ample.

Denver

Radiant Heaters in Good Demand—Vacuum Cleaners Active—Schedule Material Prices Increase

Interest in the fall election has commanded considerable attention from the electrical industry during the past week for the reason that one of the constitutional amendments referred to the people is designed to reclothe the Public Utilities Commission with the power it was originally intended that it should possess and give it jurisdiction over the home rule cities of the state. Its passage will mean the immediate authorization of at least five or six million dollars in improvements and extensions of an electrical nature.

Street-Lighting Equipment.—Several municipal jobs in the southern part of the state and a suburban project here indicate returning interest and possibilities of a number of big municipal prospects.

Radiant Heaters.—There is a good demand for the standard line, and one jobber reports inability to make further deliveries before Dec. 15. A five-dollar heater recently introduced is proving popular.

Vacuum Cleaners.—A central-station campaign is stimulating interest. Sales in outside territory are picking up.

Schedule Material.—Slight increase in price is reported. Ample stocks on hand with firm demand.

Salt Lake City

Sudden Advent of Wintry Weather Has Had Stimulating Effect on Business—Heaters Active

The sudden advent of wintry weather has had the effect of stimulating business in most lines. Electrical merchants are sharing in the increased demand for household appliances. Heating devices are moving well, including electric pads and air heaters. Building activity has slowed down considerably on account of the inclement weather. Buying is reported to be on a better scale in the farming communities. Collections are much improved.

Air Heaters.—Excessive stocks are indicated in the eagerness of some dealers to unload. A standard seller at $12.50 is offered at $7.45. A slow-up in buying is looked for with the advent of furnace weather.

Toasters.—A popular type is offered on the retail market at $5.95, this price representing a reduction from the regular quotation.

Portland-Seattle

Jobbers Report Improved Business—Appliance Stocks Are Low—Conduit Demand Is Excellent

General business is moving along in a normal manner. Portland's exports for October were less than for a year ago owing to a slump in the Japanese lumber market and to the waterfront strike, which hampers grain movement. Apple and prune shipments from the Northwest are active at this time. Fruit growers from interior towns are having much difficulty in getting their products to market on account of the shortage of cars. This shortage is also affecting lumber shipments materially, while lumber production for the past week was in excess of normal. Shipments were virtually 40 per cent below production. Building permits for the Portland district showed somewhat of a decrease over a year ago owing primarily to a very extreme shortage of cement. Seattle's permits, on the other hand, showed a very appreciable increase. In general, building seems to be progressing very satisfactorily, and electrical permits for portland were the greatest in the history of the department. Electrical jobbers report business improving. Stocks are short in many lines. Conduit shipments are arriving, but back orders take up all surplus as soon as it arrives. Electrical appliance stocks are low, particularly in the less expensive lines. Prospects for supplying the holiday trade do not look favorable. Some lines of air heaters are low, and demand is active.

Outlet Boxes.—The demand is heavy, but as with conduit the stocks are very short with no immediate prospect of an improved condition.

San Francisco

Excellent Christmas Season Expected—Collections Slightly Better—Business Good in Used Motors

An excellent Christmas season is expected. Collections are slightly better. Considerable power construction and distribution work is pending as a result of the forthcoming elections and the state vote on the power and water act. All branches of the electrical industry rallied to defeat this dangerous measure.

Motors.—Stocks are large and sales are in good volume. Used-motor shops report excellent business.

Lamps.—The expected seasonal increase is accentuated a bit by new types, such as the 75-watt white style. Miniature sales are much improved by new discount schedule.

Ranges.—Constantly increasing sales testify to efficiency of conservatively planned campaigns. One power company sold more than 100 ranges on its lines during October. This is very encouraging, considering that much of effort so far has been missionary and that effective selling organizations have had to be built up.

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Habirshaw Electric Forms a Reorganization Committee

As the result of a meeting at which forty creditors of the Habirshaw Electric Companies representing claims of more than $1,500,000 were present, a committee for the merchandise and sundry creditors of the companies was formed to confer with the existing debenture holders committee in working out plans for reorganization. Claims against the Habirshaw company total about $6,000,000, divided as follows: United States government claim, $1,000,000; debenture holder claims, $2,000,000; banks' claim, $1,500,000; merchandising claim, $1,500,000.

The committee for the merchandise and sundry creditors is composed of Malcolm D. Whitman, chairman; Wylie Brown, J. B. Beaty, G. W. Ekstrand and H. B. Hubbard, with Selden Hanley, secretary, 25 Madison Avenue, and Rabenold & Scribner, counsel.

Frank H. Stewart to Have Another Building

The Frank H. Stewart Electric Company, Philadelphia, under the title of "Business Isn't So Bad," has recently issued a formal announcement that it is now adding another building, four stories and basement, to its six-story fireproof structure, known as the "Old Mint Building," which is at 37 North Seventh Street.

Arthur H. Abbott Takes Auth Agency

Arthur H. Abbott, manufacturers' representative, 88 Broad Street, Boston, has been appointed New England agent for the Auth Electric Specialty Company, New York City, manufacturer of annunciators, push-buttons, telephones, bank apparatus, battery-charging panels, cabinets and other equipment.

Johns-Manville Company to Retire Preferred Stock

The preferred stock of the Johns-Manville Company, Inc., will be retired at $120 a share and accrued dividends during the last half of December, according to announcement made by the company. Reports were circulated in financial circles during last week that, in addition, the company contemplates the declaration of a stock dividend amounting to 400 per cent and that a special stockholders' meeting will be called to approve such action. Last week it was reported that in place of a stock dividend the company will adjust its common capitalization so that 250,000 shares of no-par-value common stock will be outstanding in place of the present 25,000 shares of $100 par value. After this is approved, stockholders will receive eight shares of new stock for each share now held, while 50,000 shares will be reserved for sale to employees on favorable terms.

Wagner Electric Company Calls Stockholders' Meeting

A letter to stockholders of the Wagner Electric Manufacturing Company from President W. A. Layman explains that the stockholders' meeting called for Dec. 29 is one of the steps incident to carrying out the plan of financial reorganization along lines agreed to.

All assets have been transferred to the new company, the Wagner Electric Corporation, and other adjustments have been made. It is desired for taxation purposes not to continue the present high capitalization of $7,500,000. Several propositions have been made upon which the stockholders will vote.

"Apex-o-meter" Says Laundry Owners Are Worried

Under the title "Laundry Owners Worried," the *Apex-o-meter*, the official organ of the Apex Electrical Distributing Company, Cleveland, comments on an article which appeared in the August issue of the *Laundry Journal*. "The popularity of electric washers is giving the owners of laundries considerable concern," says the magazine of the electrical cleaner firm.

The owner of a laundry is quoted in the article by the laundry organ, and he says: "The manufacturers of electric washers, electric driers, electric flatwork ironers and washing supplies are causing many housewives to believe that they should use these products. In their advertising the family washing is shown as being done by the housewife as she reads a book or while the children play about in the scene, with everybody all smiles. With a clever combination of sunshine and chirping birds, the otherwise burdensome household duty is shown to be quite an enjoyable affair.

"Look through any of the women's magazines. You will find them containing many advertisements and special articles depicting in words and pictures the excellent properties of domestic laundry equipment. You cannot refrain from looking at the advertisements, for they are usually representative of the highest type of the advertising art.

"When you consider the millions of women's magazines being scattered broadcast throughout the country carrying similar messages into practically every home, then you can see something of the magnitude of the campaign."

Cash Prizes for Window Decorators of Eureka Organization

One hundred and ninety dollars in cash awaits the star window decorators of the Eureka Vacuum Cleaner Company (Detroit) sales organization. This sum is the aggregate value of the fifteen prizes offered for photographs of the best window displays run during the fall housecleaning campaign. Eligible to win prizes are all distributors, dealers, branch-store managers and resale department managers.

The committee which picks the winning pictures will base its decisions on originality of arrangement, attention-attracting qualities, advertising value and sharpness of the photograph.

Changes in District Offices of Westinghouse Electric

A number of changes in the personnel of the district offices of the Westinghouse Electric & Manufacturing Company have been announced by W. S. Rugg, general sales manager of the company.

In the Pittsburgh office the power division has been changed to the central-station division with Barton Stevenson as manager. Mr. Stevenson will also be in charge of the sale of supply apparatus throughout the entire Pittsburgh district. The railway division has been changed to the transportation division, with F. G. Hickling as manager. A merchandising division has also been organized, of which F. C. Albrecht has been appointed manager.

A transportation division has been organized in the Philadelphia office, and Thomas Cooper has been appointed manager. A central-station division has been organized with H. L. Moody as manager. Mr. Moody will also be in charge of the sale of supply apparatus in the Philadelphia district, assisted by H. F. Brinckerhoff, who has been appointed assistant manager of the central-station division. W. P. Cochran will temporarily have charge of the merchandising division, which has been newly formed.

Similar changes have been made in the Detroit office. A central-station division has been established with L. Whiting as manager. Mr. Whiting will also have charge of the sale of supply apparatus. F. D. Koelbel has been made acting manager of a newly created merchandising division. A transportation division has been established with R. L. Hermann manager.

Changes in address have been made by the St. Louis and Los Angeles offices. The former office is now at 717 South Twelfth Street, St. Louis, and the latter at 420 South San Pedro Street, Los Angeles.

G. E. Company to Erect $50,000 Building at Pittsfield, Mass.

The General Electric Company is to erect a new brick and steel one-story building 400 ft. x 100 ft., at Pittsfield, Mass., to cost about $50,000. It will be used for the impregnation and treatment of wood used in the manufacture of transformers, providing a much-needed increase of facilities to meet the demands upon the transformer department. The Austin Company, New York, has the contract, which calls for the completion of the building within seventy-five days.

Sager Electric Supply Opens Branch in Brockton, Mass.

The Sager Electric Supply Company, Boston, has opened a branch wholesale house at 26 High Street, Brockton, Mass., in charge of W. M. Fyffe, formerly purchasing agent of the organization.

The Brockton branch is serving southeastern Massachusetts and the Cape Cod territory through direct contact with the trade and industry in that section.

To a representative of *Electrical World* President J. E. Sager stated that not only has the business of the Brockton branch surpassed expectations, but that the month of October, 1922, showed the best total home office business in the history of the Boston headquarters since the establishment of the parent concern in 1887.

Present upward tendencies in prices appear to be causing somewhat of a slowdown in building in eastern New England, but it is hoped that this situation will improve before long.

The Weston Electrical Instrument Company of Newark, N. J., announces that G. P. Atkinson for several years connected with its home office sales organization, has opened an office in Atlanta, Ga., for the territories of Georgia, South Carolina and northern Alabama.

The Standard Electric Works, 17 Bibb Street, Montgomery, Ala., has plans for a new factory for the construction, rebuilding, repair, etc., of electric motors.

The C. M. Sorensen Company, 177 East Eighty-seventh Street, New York City, manufacturer of electric air compressors, parts, etc., has plans nearing completion for the construction of a three-story factory, 40 ft. x 75 ft., at Radde Street and Hunter Avenue, Long Island City, to cost $60,000.

The Multi Electrical Manufacturing Company, 1848 West Fourteenth Street, Chicago, has appointed the Clark & Gansman Electric Company, 718 Cherry Street, Philadelphia, as sales agent for its "Powerlet" conduit fittings, "Multi" porcelain bushings and "Multi NEC" cut-outs. The appointed company will cover the eastern part of Pennsylvania as well as the cities of Baltimore and Washington.

The Philadelphia Fire Underwriters' Association, 131 South Fourth Street, Philadelphia, announces that charges for electrical inspections are reduced 10 per cent. This reduction took effect Nov. 4. Charles A. Hexamer is secretary of the association.

The United States Navy Central Sales Office, Washington, D. C., announces the sale of navy surplus electric elevators for handling coal, sand, gravel and ore. Bids will be opened Nov. 14.

The Beaver Machine & Tool Company, Inc., manufacturer of electrical specialties, Newark, N. J., announces that it has just appointed the Panama Lamp & Commercial Company, 595 Mission Street, San Francisco, its sales representative for the Pacific Coast.

The Ideal & Electric Manufacturing Company, Mansfield, Ohio, has announced the placing with the Austin Company, Cleveland, of its contract for an additional factory building, which is 100 ft. x 325 ft., with one 50-ft. wide, 20-ton crane aisle and two machine-shop aisles, 25 ft. wide.

The Holt Power & Light Company, Detroit, manufacturer of farm-lighting and power plants, is conducting a sales campaign direct by mail. One of its bulletins says: "From early morn till setting sun woman's work is never done —unless electrically done."

The Simplex Wire & Cable Company, Boston, announces that B. Earl Achenbach has joined its sales force and will do intensive sales work in the Philadelphia territory. For eleven years, except for two years in the Ordnance Department during the war, he has been a salesman for electrical jobbers in Philadelphia. For the past two years he has been conducting a jobbing business of his own in Virginia.

The General Refractories Company, Oliver Building, Pittsburgh, has acquired the plants and businesses of the Hayes Run Fire Brick Company, Orviston, Pa., and the Pennsylvania Fire Brick Company, Beech Creek, Pa. These properties will be consolidated with others lately purchased in the same section and continued in operation. The purchasing company has arranged to operate with a capital of $18,000,000.

The Maniscalco New Power System Company, M. & M. Bank Building, Sharon, Pa., it is announced, is arranging for the installation of machinery in a local building to manufacture a special type of electric motor and parts.

The Raymith Manufacturing Company, manufacturer of electrical switch boxes, 3707 Ogden Avenue, Chicago, announces that it has leased the first floor, 50 ft. x 125 ft., of the building at 1943 Carroll Avenue, for a term of five years.

The Ohio Electric Controller Company, 5900 Maurice Avenue, Cleveland, announces the opening of a district sales office at 53 West Jackson Boulevard, Chicago.

Foreign Trade Notes

AN ELECTRIC PLANT AUTHORIZED IN HONDURAS.—The Honduran Congress has issued, *Commerce Reports* states, a decree granting the Esfuerzo Electrico Comercial of Colinas, Santa Barbara, Honduras, rights to establish an electric plant at any point in the district of Santa Barbara. Free entry of material and supplies is provided for a period of five years. The plant must be installed by April, 1924.

PROPOSED NEW AUTOMATIC TELEPHONE EXCHANGE AT SYDNEY AUSTRALIA.—The erection of a new telephone exchange, with a capacity of 16,000 lines, at Sydney, Australia, has been recommended by the Australian Federal Public Works. The cost is estimated at £404,000.

ELECTRIC STREET LAMPS TO REPLACE GAS LAMPS IN AUCKLAND, NEW ZEALAND. — Plans are being prepared by W. E. Bush, city engineer, to replace the gas street lamps now in use with electric lamps in the city of Auckland, New Zealand.

ELECTRIC DISTRIBUTION SYSTEM PROPOSED FOR STANLEY POOL, BELGIAN CONGO.—Tenders will be received by the Belgian Ministère des Colonies, 20 Rue de Namur, Brussels, until Jan. 5 for the installation of an electric distribution for the town of Stanley Pool in the Belgian Congo, and to operate the system under a thirty-year concession, beginning Jan. 1, 1923.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency is desired in New Zealand (No. 4,189) for wireless apparatus and accessories.

Purchase is desired in Norway (No. 4,217) of electric installation and telephone materials, insulated cables, 1.5 sq.mm. to 100 sq.mm., electrolytic copper, high-tension magnetos, high-tension spark plugs and automobile supplies.

Purchase is desired in Mexico (No. 4,232) of a radio-telephone receiving set, capable of receiving over a distance of 1,500 to 2,000 miles, with amplifying transmitter for an audience of 200 persons.

An agency is desired in Canary Islands (No. 4,239) for electrical appliances for lighting, telephone and telegraph services.

An agency is desired in Australia (No. 4,241) for electrical accessories, switchgear, fittings, electrical glassware, insulating materials, wires and cables, heating appliances, etc.

An agency is desired in Norway (No. 4,245) for all kinds of electrical goods and wireless broadcasting systems.

CONCESSIONS GRANTED FOR AN ELECTRIC PLANT IN SANT' ANNA, BRAZIL.—By a decree published Aug. 18, according to *Commerce Reports*, exclusive rights have been granted for furnishing electricity for lighting and power purposes to the municipality of Sant' Anna do Ipanema, Alagoas, Brazil. The concessionaires are required to furnish thirty-five street lamps of 50 cp. each. The plant must be established within twelve months after the approval of the contract. The municipality had a population of 40,234 in 1920. There are no railroad connections.

New Incorporations

THE POWER CORPORATION OF NEW YORK, Watertown, N. Y., has filed articles of incorporation with the Secretary of State. The company proposes to issue 100,000 shares of preferred stock having a par value of $100 and 300,000 shares of common stock having no par value. The directors are John N. Carlisle, D. C. Middleton C. B. Martin, Watertown.

THE WILLIAMSPORT (MD.) POWER COMPANY has been chartered with a capital stock of $250,000 by Joseph C. Byron, Clarence M. Stickell and John R. Keiffer. The company will build the power plant at Williamsport which is to supply electricity for the Hagerstown & Frederick Railway Company and its allied interests.

THE LINCOLN COUNTY LIGHT & POWER COMPANY, Portland, Ore., has been incorporated by H. A. Holland, Maurice W. Seitz and M. E. McDermott. The company is capitalized at $40,000.

New Apparatus and Publications

FEED-WATER HEATERS AND PURIFIERS.—Catalog No. 80 issued by the Hoppes Manufacturing Company, Springfield, Ohio, describes and illustrates the "Hoppes" feed-water heaters, purifiers, steam separators, oil eliminators, exhaust heads and V-notch water meters and other products of the company.

AUTOMATIC DRILL PRESS. — Joseph W. Jones, 29 West Thirty-fifth Street, New York City, is distributing a leaflet covering the "Jones" automatic drill press recently placed on the market.

BATTERY CHARGER. — A new-type radio and automobile battery charger, known as the "Valley" type "A and B" charger, has been placed on the market by the Valley Electric Company, 3157 South Kingshighway Boulevard, St. Louis.

ELECTRIC MOTOR.—A new revulsion type of electric motor for temperature regulator use has been placed on the market by the Honeywell Heating Specialties Company, Wabash, Ind. This device was developed by the engineers of the company in co-operation with the General Electric Company.

ULTRA-VIOLET LIGHT. — The Cooper Hewitt Electric Company, 95 River Street, Hoboken, N. J., is distributing bulletins Nos. 400, 401, 402 and 403, describing the use of ultra-light for phototherapy, sterilization and photochemistry; "Uviarc" lamps in the laboratory, the "Lab-Arc," and quartz-glass apparatus for photophysics and photochemistry respectively. Bulletin No. 99 explains the "Uviarc" test method for dyes, textiles, paints, inks, etc.

HEATER PLUG.—A new heater plug, known as the "Beaver Gripall," has recently been developed by the Beaver Machine & Tool Company, Inc., 625 North Third Street, Newark, N. J. This heater plug has been approved by the National Board of Underwriters.

AUTOMOBILE DEFECTOMETER.—Paul G. Niehoff & Company, 232 East Ohio Street, Chicago, has placed on the market a new model of its automobile defectometer.

ELECTRIC GRINDER. — An electric grinder with a type "NU" motor has been placed on the market by the Marathon Electric Manufacturing Company, Wausau, Wis.

PANELBOARD. — A unit-construction panelboard, "T-P," with two branch circuit connections and carrying switches, etc., has been placed on the market by the Frank Adam Electric Company, St. Louis.

DISK FAN.—The Kimble Electric Company, 634 Northwestern Avenue, Chicago, has placed on the market a variable-speed reversible disk fan.

ELECTRIC HEATER.—The A. C. Gilbert Company, New Haven, Conn., has recently placed on the market a new electric heater, known as the "Polar Cub."

INDUCTION MOTOR. — A repulsion-start induction motor has recently been developed by the Dayton Fan & Motor Company. It is made in four sizes ranging from ¼ hp. to ½ hp.

ARMORED CONDUCTOR.—An armored conductor, "Uniduct," made with two or three conductors, No. 12 or No. 14 wire, has been developed by the Appleton Electric Company, 1701 Wellington Avenue, Chicago.

CIRCUIT BREAKERS.—"Protection Up to Date" is the title of a 98-page booklet published by the Cutter Company, Philadelphia, covering its "U-re-lite" circuit breakers.

ELECTRIC DRYING MACHINE.—An electrically-heated clothes drying machine has recently been developed by the Canton Clothes Dryer Company, Canton, Ohio.

AUTOMATIC LAUNDRY EXTRACTOR. —The American Laundry Machinery Company, Cincinnati, has recently brought out the "Humatic" clothes extractor for commercial laundries.

ELECTRIC ANNOUNCING DEVICE.— The Bulletin Machine Company, 10-16 Lock Street, Buffalo, is manufacturing the "Davis" Annunciator," an electric announcing device for vaudeville theaters.

ELECTRIC GLUE POT.—The J. D. Wallace & Company, 1401 West Jackson Boulevard, Chicago, has placed on the market a new bench glue pot with automatic heat control.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUGUSTA, ME.—The Central Maine Power Company has started work on extensions to three of its power plants, which will include the installation of an additional 1,000-hp. generating unit at the Waterville station, a 1,300-hp. additional unit, making the fourth, at the Skowhegan plant, and a 1,500-hp. unit at the Deer Rips station, for which an order has been placed. In addition to this a 4,000-kw. synchronous condenser will be installed at the Deer Rips station and a new transmission line erected from the station to Lewiston.

BAR HARBOR, ME. — The Penobscot County Water Company has been granted permission to issue $403,000 in capital stock for the purchase of the properties of the Bar Harbor & Union River Power Company, the Orono Water Company and the Bangor Railway & Electric Company. The properties will be consolidated and extended and improved.

VAN BUREN, ME.—The Van Buren Light and Power District has granted the Cyr Electric Company, recently organized, permission to supply electrical service in certain districts.

BRATTLEBORO, VT.—The Presbrey-Leland Quarries, Inc., contemplates equipping its new granite sheds, in course of construction, with electrically driven machinery. From 600 hp. to 800 hp. will be required.

BOSTON, MASS.—The Eastern Massachusetts Electric Company has applied for permission to issue $110,000 in capital stock and $75,000 in bonds, part of the proceeds to be used for extensions and improvements.

HOLYOKE, MASS.—The proposed plant of the Holyoke Gummed Products Company to be erected at South Hadley Falls will be operated by electricity. The contract for electrical equipment will soon be awarded. Energy to operate the plant will be supplied by the Electric Light Department of South Hadley.

LOWELL, MASS.—Plans for extensions to the ornamental system have been submitted to the Lowell Electric Light Company for an estimate of cost by the Public Service Board. The lamps, it is understood, will not be installed until next spring.

Middle Atlantic States

DEPEW, N. Y.—The Depew & Lancaster Light, Power & Conduit Company is preparing plans for additions to its power plants, including the installation of equipment.

LE ROY, N. Y.—The Genesee Light & Power Company has applied to the Public Service Commission for authority to issue $85,000 in capital stock, the proceeds to be used to acquire the property of the Le Roy Hydraulic Electric & Gas Company.

MONTICELLO, N. Y.—Application has been made to the Public Service Commission by the Murray Electric Light & Power Company for permission to issue capital stock to finance proposed extensions and improvements to its system.

NEW YORK, N. Y.—The George H. Stern Lumber Company, 545 East Seventy-first Street, will build a power house at its new yard on Sixty-ninth Street and Avenue A. William H. Gompert, 117 Madison Avenue, architect.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company, 466 Lexington Avenue, until Nov. 16, for electric motors and controlling apparatus. (Serial Contract 32-1922.) C. S. White, Room 344, 466 Lexington Avenue, is purchasing agent.

NEW YORK, N. Y.—A power house and refrigerating plant will be installed in the proposed municipal market to be constructed by the Department of Plant and Structures. Municipal Building, in the vicinity of the 149th Street bridge, Harlem River, to cost about $5,000,000.

NEW YORK, N. Y.—A power department, including electric, ice and refrigerating plants, will be installed in the fourteen-story hospital to be erected on Livingston Place, near Sixteenth Street, by the Beth

Israel Hospital, 70 Jefferson Street to cost about $3,000,000. Louis A. Abramson, 46 West Forty-sixth Street, is architect.

NORWICH, N. Y.—The New York State Gas & Electric Company contemplates the erection of a 44,000-volt transmission line, to cost about $25,000.

WHITE PLAINS, N. Y.—A power house will be built in connection with its proposed new hospital to be erected on Mamaroneck Avenue, at a cost of about $500,000 for the New York Orthopedic Hospital, Third Avenue and Twenty-third Street, New York City.

BELLEVILLE, N. J.—The Town Commission is considering improvements to the street lighting system.

HACKETTSTOWN, N. J.—The New Jersey Power & Light Company has acquired the Hackettstown Electric Light Company and will consolidate the property with its system in this district. A transmission line will be erected from Dover to Hackettstown.

NEWARK, N. J.—A power house and electrical equipment will be installed in the new baking plant, to be erected on Abington Avenue, Third to Fourth Street, by Dugan Brothers, 287 Broadway, Brooklyn, N. Y., to cost about $200,000.

PATERSON, N. J.—Considerable electric power equipment will be installed in the printing plant to be erected at Twenty-fourth and Eighteenth Streets, by the Paterson Industrial Development Company, to cost about $400,000. Walter Kidde & Company, 140 Cedar Street, New York, are engineers.

TRENTON, N. J.—The Eberhard Watch Corporation of America, recently organized, will build a power house in connection with its proposed plant in the Woodside Park section to cost about $150,000. The company is represented by Marvin L. Spaulding, 147 East State Street.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company has purchased the Heidelberg Power & Light Company, recently organized to operate in Lehigh County.

BETULA, PA.—The Saeger Glass Jar Corporation will build a power plant in connection with its proposed local factory.

BLOSSBURG, PA.—Plans are under consideration by W. T. Merrick, Wellsboro, and associates for the installation of an electric light and power system, to cost about $30,000.

EASTON, PA.—The Lower Milford-Lehigh Power Company, Dunham-Busks Power Company, Washington-Berks Power Company and Hereford-Berks Power Company, recently organized, plan to install electric systems in their respective territories.

PHILADELPHIA, PA.—The Ketterlinus Lithographic Manufacturing Company, Fourth and Arch Streets, will install an electrical department in its proposed eight-story plant addition.

PHILADELPHIA, PA. — The Wilmot Fleming Iron & Steel Company, 956 Foulkrod Street, will install a power house at its new iron and steel plant on Cottman Street, now in course of erection.

PHILADELPHIA, PA.—The Breyer Ice Cream Company, Ninth and Cumberland Streets, will build a power house, an ice-making and refrigerating plant in connection with its proposed works to be erected on Forty-third Street, near Woodland Avenue, to cost about $500,000.

POTTSVILLE, PA. — Considerable electric power equipment will be installed at the proposed printing plant to be erected by the Pottsville *Daily Republican*, estimated to cost $500,000.

BALTIMORE, MD. — The Baltimore & Ohio Railroad Company plans to rebuild the grain elevator at Locust Point, which was destroyed by fire last July. The cost is estimated at about $3,000,000. John S. Metcalf & Company, 108 South La Salle Street, Chicago, are engineers.

HAGERSTOWN, MD. — The Potomac Public Service Company will extend its transmission lines in Garrett County to serve new coal properties throughout that section.

WILLIAMSPORT, MD.—The Potomac Public Service Company has been organized by the officials of the Williamsport Power Company, with capital of $250,000, to construct and operate its proposed generating plant at a cost of about $5,000,000.

SHINNSTON, W. VA.—The Alley Glass Company will build a power house in connection with its proposed new plant, to cost about $300,000, with equipment.

DANVILLE, VA.—The Municipal Electric Light Department is planning to extend its transmission line to Stokesland and install a distributing system there.

NORFOLK, VA.—Bids will be received by the United States Engineer Office until Dec. 2 for the construction of two power plants at Fort Story, Cape Henry.

NORFOLK, VA.—George W. Taylor & Company, Haddington Building, will remodel and improve their ice-manufacturing plant and will install new electrical equipment, to cost about $100,000. Ophuls & Hill, 112 West Forty-second Street, New York, are engineers.

PETERSBURG, VA.—The Virginia Railway & Power Company is considering doubling the output of its Locks power plant. The erection of a 110,000-volt transmission line from Richmond to Portsmouth, with two substations is also contemplated. The cost is estimated at about $250,000.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Nov. 20 for switchboard supplies, as per Circular 12873—1 C.P.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Nov. 18 for electrical supplies, as per Circular 11229—A—4 C.P.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Nov. 17 for two storage batteries (Circular 12945—A—1 C.P.).

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Nov. 22 for equipment for the Canal Zone, including high-tension insulators, electric motors, transformers and copper wire (Circular 1500).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until Nov. 15 for 125 junction fuse boxes (Circular 23-41); also, until Nov. 14 for 300 Liberty switch 2-ohm resistance units (Circular 476).

North Central States

HOLT, MICH. — The Consumers' Power Company will extend its transmission line from Lansing to Holt, with branch lines to Pine Lake, Okemos and Haslett, for light and power service.

JACKSON, MICH.—Bids will be received by the Treasury Department, Supervising Architect's Office, Washington, D. C., until Nov. 22 for the installation of an electric freight elevator at the local post office.

MONTAGUE, MICH.—The property of the White Lake Power Company has been purchased by the Commonwealth Light & Power Company, 141 Broadway, New York City. Extensions, it is understood, will be made to the property.

PORTLAND, MICH.—A bond issue of $12,000 is being arranged for the installation of additional equipment in the municipal power plant.

AKRON, OHIO.—The installation of an ornamental lighting system extending from Cuyahoga Falls over the new viaduct into Akron and to South Kenmore, a distance of about 5 miles, is under consideration by the City Council and local business men.

BOWLING GREEN, OHIO.—The Council is considering the installation of ornamental lighting system to replace the arc lamps now in use. The cost is estimated at about $40,000.

CINCINNATI, OHIO.—The Union Gas & Electric Company plans to rebuild its electric substation, recently damaged by fire, causing a loss of about $45,000.

CLEVELAND, OHIO.—The City Council is considering the installation of an ornamental lighting system on Lorain, Clark and Prospect Avenues and Broadway, to cost about $115,000.

CLEVELAND, OHIO.—The City Council is considering extensions to the municipal electric system, including the construction of a new plant, extensions to distribution lines, etc., to supply 15,000 additional consumers. The cost is estimated at $10,400,000. A. B. Roberts is director of public utilities.

DELAWARE, OHIO. — The Department of Public Welfare, Columbus, contemplates the construction of a power house and laundry and two reservoirs, small pumping station, etc., at the Girls' Industrial Home here, to cost about $25,000.

SYCAMORE, OHIO.—Bonds to the amount of $23,000 have been issued for extensions to the municipal electric light system.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company will install additional machinery at its hydro-electric power plant on the White River, to cost about $150,000.

HARVEY, ILL.—A one-story power house will be erected at the Memorial Hospital. Chatten & Hammond, 64 East Van Buren Street, Chicago, are architects.

BEAVER, WIS.—The Wisconsin Power, Light & Heat Company has applied to the Wisconsin Railroad Commission for authority to issue $120,000 in capital stock for the purpose of acquiring the property of the Beaver Dam Light & Fuel Company.

MANITOWOC, WIS.—A second transmission line will be erected from the local power plant of the Wisconsin Public Service Corporation to the city of Two Rivers. The cost is estimated at about $16,500.

STRATFORD, WIS.—The Stratford Light & Power Company has petitioned the Railroad Commission for authority to issue $12,000 in bonds for the purpose of erecting a transmission line and substation to supply electricity in Stratford. Energy will be obtained from the Wisconsin Valley Electric Company at Wausau.

THREE LAKES, WIS. — The Electric Light and Power Commission of Eagle River has submitted a proposal to the Village Board offering to furnish electrical service in Three Lakes.

EXCELSIOR SPRINGS, MO.—The Excelsior Springs Water, Gas & Electric Company plans to install a local substation and electric system.

MAYSVILLE, MO.—The Maysville Electric Company, contemplates additions in its plant, including the installation of equipment.

ST. LOUIS, MO.—The Board of Public Improvements contemplates the construction of a municipal power plant at Clark and Twelfth Streets, to cost about $1,000,000.

ST. LOUIS, MO.—The United States Public Service Company has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

OMAHA, NEB.—The Continental Gas & Electric Corporation has acquired the properties of the Union Power & Light Company, operating in Nebraska, Iowa and South Dakota. The system will be merged and extensions and improvements made.

LEAVENWORTH, KAN. — The Kansas Electric Power Company has issued $1,000,000 in capital stock, part of the proceeds to be used for extensions and improvements.

Southern States

ATHENS, GA.—The Atlantic Ice & Coal Corporation will install electric power equipment at its proposed refrigerating and cold-storage plant, to cost about $70,000.

BRADENTOWN, FLA.—The Board of Trade is developing plans for the installation of an ornamental lighting system in the city park on the waterfront.

CLERMONT, FLA.—The Clermont Ice Company plans to install a substation and electric equipment at its proposed ice-manufacturing plant.

GROVELAND, FLA.—Preliminary plans are being considered for the installation of a street-lighting system. A municipal ice-manufacturing plant is also planned.

MACCLENNY, FLA. — The Macclenny Electric Company is considering extensions to its power plant and system.

KNOXVILLE, TENN. — The Knoxville Power & Light Company has authorized a fund of $430,000 for plant and system extensions and improvements.

MEMPHIS, TENN.—Bids will be received at the office of the Mississippi River Commission, First and Second Districts, Custom House, Memphis, until Dec. 2 for furnishing turbines, pumps, feed-water heater, boiler-feed pumps and an electric light plant.

SHUBUTA, MISS.—The Spinks Ice & Manufacturing Company plans to erect an auxiliary electric plant, to be operated in conjunction with its present hydro-electric station.

PLAQUIMINE, LA.—Bonds to the amount of $150,000 have been issued for remodeling the municipal electric power plant.

CEMENT, OKLA. — Plans are being drawn for extensions and improvements to the municipal power plant and distributing system. The proposal to issue $33,000 in bonds for the work will be submitted to the voters on Nov. 21. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

COLLINSVILLE, OKLA.—The City Council is considering closing down the municipal electric generating plant and purchasing electricity to operate the local system.

WANETTE, OKLA. — Plans are being prepared for extensions to the street-lighting system. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

CELINA, TEX.—The proposal to issue $50,000 in bonds for the installation of an electric light plant and waterworks system will be submitted to the voters on Nov. 28.

HOUSTON, TEX.—The Houston Lighting & Power Company has filed notice of increase in capital from $3,000,000 to $4,500,000, part of the proceeds to be used for the construction of a new generating plant.

STAMFORD, TEX.—Extensions to the plant of the Stamford Gas & Electric Company are reported to be under consideration.

TULIA, TEX.—Bonds to the amount of $100,000 have been voted for extensions to the electric light, water and sewer systems. A new electric plant will be built.

Pacific and Mountain States

COLVILLE, WASH. — A franchise has been granted to the Stevens County Power & Light Company for the erection of a transmission line along the Inland Empire Highway between Moyers Falls and Chewelah.

DEER PARK, WASH. — The Mount Spokane Power Company has disposed of $100,000 in bonds, the proceeds to be used for extensions to its hydro-electric plant and system, including raising dam, new flume, canals, generators and other equipment, transmission lines, etc. The Nixon-Kimmel Company, S 169 Wall Street, Spokane, is engineer.

GRANITE FALLS, WASH.—The property of the Granite Falls Electric Company has been purchased by the Puget Sound International Railway & Power Company, Everett. The local system, it is understood, will be connected with the high-tension transmission lines of the Puget Sound company.

NORTHPORT, WASH. — The Northport Power & Light Company will erect a transmission line to the Deep Creek district.

SPOKANE, WASH.—Surveys are being made by the Washington Water Power Company for the erection of a 69,000-volt transmission line to Pateros on the Columbia River to connect with the lines of the Okanogan Valley Power Company, which it will take over Jan. 1. The proposed line will extend from Coulee City to Pateros, a distance of 54 miles.

CROWS LANDING, CAL.—Plans for the new irrigation project of the West Stanislaus Irrigation District provide for four electric booster plants and a main electrically driven pumping station. The cost is estimated at $600,000. E. N. Bryan, Forum Building, Sacramento, is engineer.

HANFORD, CAL. — Negotiations are under way for the purchase of the distributing system of the Southern California Edison Company, to be operated by the municipality. Extensions are contemplated.

SACRAMENTO, CAL.—Property owners on Fifth Street between J and I Streets and on I Street between Fifth and Ninth Streets will install an ornamental lighting system. The city has granted approval.

SAN BERNARDINO, CAL. — Contract will soon be let for the installation of an ornamental lighting system on F, E and South Third Streets.

SANTA CRUZ, CAL.—Contract will soon be let for the installation of a lighting system in the Boulder Creek district.

STOCKTON, CAL.—The Western States Gas & Electric Company has issued notes for $5,000,000, part of the proceeds to be used for extensions and improvements.

LOGAN, UTAH.—The City Council has applied for permission to construct a municipal hydro-electric plant on the Logan River, near the State Dam. The initial installation will provide for 1,000 hp.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has surveys in progress for its proposed hydro-electric power plant at Soda, on the Bear River, with initial capacity of about 11,000 hp.

FORT MORGAN, COL.—Bonds to the amount of $125,000 have been voted for the construction of a new municipal electric light plant.

Canada

WEST VANCOUVER, B. C. — Arrangements have been made whereby the British Columbia Electric Railway Company, Ltd., will supply electricity in West Vancouver. A bylaw will soon be submitted to the ratepayers to provide funds to establish the service.

LONDON, ONT.—Arrangements are being made by the Public Utilities Commission for the erection of a new hydro-electric substation in the vicinity of the Grand Trunk Railway carshops.

MAGOG, QUE.—The Council is considering submitting a bylaw to the ratepayers providing $50,000 for improvements to the municipal electric light plant.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 17, 1922)

1,432,442. ELECTRIC FURNACE; E. F. Collins, Schenectady, N. Y. App. filed March 1, 1921. Resistance element in form of arc over material.

1,432,455. METHOD AND APPARATUS FOR RECEIVING SUSTAINED WAVE SIGNALS; A. N. Goldsmith, New York, N. Y. App. filed July 28, 1919. Incoming energy modulated at audible frequency.

1,432,456. METHOD AND APPARATUS FOR TRANSMITTING SUSTAINED WAVE SIGNALS; A. N. Goldsmith, New York, N. Y. App. filed July 29, 1919. Radio-tone transmission from sustained wave generator.

1,432,491. ELECTRIC HEATER; S. I. Phelps, Rockford, Ill. App. filed March 24, 1919. Grill plate.

1,432,508. PASTE FOR STORAGE-BATTERY PLATES; T. A. Willard, East Cleveland, Ohio. App. filed June 2, 1917. Paste for negative plates containing oxide of lead and wood dust.

1,432,543. ART OF MAKING ELECTROLYTIC IRON; F. A. Eustis, Milton, C. R. Hayward, Quincy, H. M. Schleicher and D. Belcher, Boston, Mass. App. filed July 7, 1921. Reducing ferric solution to ferrous state with hydrogen sulphide, precipitating sulphur, then depositing iron.

1,432,544. ART OF MAKING ELECTROLYTIC IRON; F. A. Eustis, Milton; C. R. Hayward, Quincy; H. M. Schleicher and D. Belcher, Boston, Mass. App. filed Jan. 17, 1922. Electrolytic solution of iron oxide dissolved in dilute acid and ferrous salt.

1,432,556. MEANS FOR INDICATING AND DISCONNECTING DEFECTIVE BRANCHES FROM ELECTRIC CURRENT NETWORKS; M. Hochstadter, Gravenhage, Netherlands. App. filed July 27, 1920. Apparatus for disconnecting short-circuited line from distribution system.

1,432,584. ELECTRIC MOTOR; R. H. Williams, Richmond, Ind. App. filed Aug 23, 1918. Oppositely rotating armatures placed side by side to reduce vibration.

1,432,600. AUTOMATIC SIGNALING SYSTEM FOR INDUSTRIAL ESTABLISHMENTS; W. L. Jacoby, Larchmont, N. Y., and R. M. Hopkins, Rutherford, N. J. App. filed May 7, 1918. Makes it possible to locate any one passing through plant.

1,432,618. AUTOMATIC TELEPHONE SELECTING SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Jan. 24, 1919. Means of controlling the movements and release of switches employed in interconnecting lines.

1,432,623. TELEPHONE; G. B. Riley, London, England. App. filed April 26, 1921. Type used on vehicles, trains, ships, aircraft, etc.

1,432,627. EMPLOYEE'S TIME-REGISTERING APPARATUS; F. B. Shenstone, Sydney, New South Wales, Australia. App. filed Jan. 5, 1922. Electrically operated and clock-controlled mechanism.

1,432,637. SUPPORTED LAMINATIONS FOR ELECTRICAL APPARATUS AND METHOD OF MAKING THE SAME; H. F. Stratton, Cleveland, Ohio. App. filed Sept. 21, 1921. Metal frame cast around annual laminations.

1,432,650. LIGHT-CONTROL SWITCH; C. J. White, Long Beach, Cal. App. filed March 15, 1921. Switch contains resistances for dimming lights.

1,432,711. CLAMP; R. H. Manson, Rochester, N. Y. App. filed Feb. 13, 1920. Clamp for fastening impulse-transmitting devices to telephone instruments.

1,432,712. ELECTRIC FUEL VAPORIZER; F. H. Mark and H. J. McConochy, Portland, Ind. App. filed Jan. 6, 1922. Electric heating element across inlet manifold.

(Issued Oct. 24, 1922)

15,477 (reissue). ELECTRIC HEATING ELEMENT; F. W. Moffat, Weston, Ontario, Can. App. filed Jan. 5, 1922. Plate type.

15,478 (reissue). RHEOSTAT; F. A. Rojas, New York, N. Y. App. filed Jan. 30, 1922. Rheostat of compressible resistance material with means for drawing material apart to lessen its conductivity.

1,432,781. MEANS FOR AND METHOD OF AVOIDING INTERFERENCE; H. S. Osborne, New York, N. Y. App. filed July 31, 1918. Avoidance of disturbances from outside sources in ocean cables.

1,432,800. INSULATED SUPPORT FOR ELECTRICAL CONDUCTORS; L. Steinberger and G. Hill, Brooklyn, N. Y. App. filed May 18, 1918. Applied to radio apparatus dealing with currents of high frequency and high potential.

1,432,806. SEALING DEVICE FOR BATTERY TERMINALS; E. G. Templeton, Akron, Ohio. App. filed April 17, 1922. Grooved rubber washer and metallic retaining member.

1,432,823. ELECTRODE HOLDER FOR ELECTRIC FURNACES; J. Young, Welland, Ontario, App. filed April 12, 1920. Water-cooled holder in which water acts as conductor to electrode.

1,432,826. AUTOMOBILE SIGNAL; M. J. Barnett, San Francisco, Calif. App. filed Jan. 26, 1920. Direction signal on rear of automobile.

1,432,829. ELECTRICAL TESTING SYSTEM; F. H. Best, Westfield, N. J. App. filed Dec. 30, 1921. For measuring impedance unbalance between loaded signaling circuits.

1,432,831. PLANER AND SYSTEM OF MOTOR CONTROL THEREFOR; H. L. Blood, Plainfield, N. J. App. filed Aug. 1, 1921. Reciprocating table positively connected with electric motor which is periodically reversed.

1,432,844. CONTACT CARRIER; H. A. Douglas, Bronson, Mich. App. filed Feb. 4, 1918. Miniature light socket.

1,432,845. BATTERY GRID AND PROCESS OF MAKING SAME; H. I. Edney, Wirt, Okla. App. filed Feb. 26, 1920. Filling paste of an active material, collodion, sulphuric acid and a carbonate.

1,432,852. TELEPHONE SWITCHING KEY; A. D. Hargan, Bayonne, N. J. App. filed Aug. 26, 1921. Interlocking device for ringing keys.

1,432,856. MAXIMUM-DEMAND WATTMETER; J. Harris, Lafayette, Ind. App. filed Feb. 2, 1920. Adapted either to alternating-current or direct-current circuit.

1,432,863. TRANSMISSION SYSTEM; K. S. Johnson, Jersey City, N. J. App. filed July 1, 1918. Improving quality of transmission from incoming line to vacuum-tube repeater.

1,432,867. ELECTRON DISCHARGE DEVICE AND METHOD OF MAKING THE SAME; M. J. Kelly, New York, N. Y. App. filed Nov. 15, 1919. Amplifier comprising a cathode and anode with coating having good heat-radiating qualities on anode.

1,432,868. SECTIONAL SWITCHBOARD FRAME; H. Koch, Jamaica, N. Y. App. filed June 17, 1921. Switchboard construction for telephonic apparatus.

1,432,871. SWITCHBOARD MECHANISM; H. F. Krantz, Brooklyn, N. Y. App. filed Aug. 5, 1918. Heavy current switch.

1,432,876. PORTABLE ELECTRIC LAMP; P. J. L'Evesque, Paris, France. App. filed March 17, 1920. Two lamps and projectors, one with parallel beam and the other for diffused lighting.

1,432,883. ELECTRICAL SWITCHING DEVICE; N. H. Lysons, Montreal, Can. App. filed Sept. 14, 1920. Telephone hook switches.

1,432,885. TELEPHONE TRANSMITTER; J. P. Minton, East Orange, N. J., and C. A. Finley, Brooklyn, N. Y. App. filed March 27, 1918. Suitable for places subjected to severe extraneous noises.

1,432,894. SHUTTLE FOR WRAPPING MACHINES; W. B. Pierce, Chicago, Ill. App. filed April 29, 1920. Adapted to apply spiral wrapping around object with one or more reinforcing wrappings.

1,432,903. ENGINE-DRIVEN ELECTRIC GENERATOR UNIT; C. E. Reddig, Richmond Hill, N. Y. App. filed Sept. 17, 1920. Fans force air through ventilating passages of engine and generator.

1,432,907. PORTABLE ELECTRIC LANTERN; C. S. Rhoads, Jr., Yonkers, N. Y. App. filed May 27, 1920. Combined automobile headlight and trouble light.

1,432,915. SPARK-ADJUSTING APPARATUS; W. E. Schwarzmann, Longmeadow, Mass. App. filed Dec. 23, 1920. Short-circuit device for timing mechanism of magneto ignition systems.

1,432,925. IMPULSE SENDER; G. Thompson, Mount Vernon, N. Y. App. filed Nov. 3, 1919. Adapted for use in telephone exchange to differentiate between parties making call.

1,432,931. ELECTRIC DISCHARGE DEVICE; H. W. Weinhart, Elizabeth, N. J. App. filed Nov. 1, 1916. Electron tube with hollow electrode adapted to have cooling fluid pass through it.

1,432,937. STORAGE BATTERY; W. H. Wood, Cleveland, Ohio. App. filed Jan. 22, 1920. Porous active material allows electrolyte access to internal parts.